Candidate surname			ng your candidate information Other names
Pearson Edexcel International Advanced Level	Centre	e Number	Candidate Number
Monday 18 Ja	anu	ary	2021
Morning (Time: 1 hour 30 minut	es)	Paper Ref	ference WMA12/01
Mathematics	ad Sub	osidiary	/Advanced Level
Pure Mathematics P2	.a sak	Januar y	

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 ▶







$f(x) = x^4 + ax^3 - 3x^2 + bx + 5$
` /

where a and b are constants.

When f(x) is divided by (x + 1), the remainder is 4

(a) Show that a + b = -1

**(2)** 

When f(x) is divided by (x-2), the remainder is -23

(b) Find the value of a and the value of b.

**(4)** 

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Question 1 continued	

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		Q1
	(Total 6 marks)	



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Z.	Α	curve	nas	equation

$$y = x^3 - x^2 - 16x + 2$$

(a) Using calculus, find the x coordinates of the stationary points of the curve.

**(4)** 

(b) Justify, by further calculus, the nature of all of the stationary points of the curve.

**(3)** 

Question 2 continued		Leav blan
	Q	2
	(Total 7 marks)	



3. (i) Solve

$$7^{x+2} = 3$$

giving your answer in the form  $x = \log_7 a$  where a is a rational number in its simplest form.

**(3)** 

(ii) Using the laws of logarithms, solve

$$1 + \log_2 y + \log_2 (y + 4) = \log_2 (5 - y)$$
(5)



uestion 3 continued	
	Q



9

4. (a) Find the first three terms, in ascending powers of x, of the binomial expansion of

$$(2+px)^6$$

where p is a constant. Give each term in simplest form.

(4)

Given that in the expansion of

$$\left(3 - \frac{1}{2}x\right)\left(2 + px\right)^6$$

the coefficient of  $x^2$  is  $-\frac{3}{4}$ 

(b) find the possible values of p.

**(4)** 


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uestion 4 continued	0



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Question 4 continued	d		

Question 4 continued		blank
		Q4
	(Total 8 marks)	



5. (i) Use algebra to prove that for all $x \ge 0$ $3x + 1 \ge 2\sqrt{3x}$	
	(3)
(ii) Show that the following statement is not true.	
"The sum of three consecutive prime numbers is always a multiple of 5"	(1)
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Question 5 continued		blan
		Q5
	(Total 4 marks)	



**6.** (a) Show that the equation

$$\frac{3\sin\theta\cos\theta}{2\sin\theta - 1} = 5\tan\theta \qquad \sin\theta \neq \frac{1}{2}$$

can be written in the form

$$3\sin^3\theta + 10\sin^2\theta - 8\sin\theta = 0$$

**(4)** 

(b) Hence solve, for  $-\frac{\pi}{4} < x < \frac{\pi}{4}$ 

$$\frac{3\sin 2x\cos 2x}{2\sin 2x - 1} = 5\tan 2x$$

giving your answers to 3 decimal places where appropriate.

**(4)** 


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Question 6 continued	



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Question 6 continued		

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	<b>Q6</b>
(Total 8 marks)	



7.

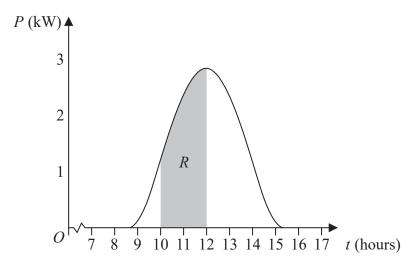


Figure 1

Solar panels are installed on the roof of a building.

The power, P, produced on a particular day, in kW, can be modelled by the equation

$$P = 0.95 + 2^{t-12} + 2^{12-t} - (t-12)^2$$
 8.5  $\leq t \leq 15.2$ 

where t is the time in hours after midnight. The graph of P against t is shown in Figure 1.

A table of values of t and P is shown below, with the values of P given to 4 significant figures where appropriate.

Time, t (hours)	10	10.5	11	11.5	12
Power, P (kW)		1.882	2.45		2.95

(a) Use the given equation to complete the table, giving the values of P to 4 significant figures where appropriate.

The amount of energy, in kWh, produced between 10:00 and 12:00 can be found by calculating the area of region *R*, shown shaded in Figure 1.

(b) Use the trapezium rule, with all the values of *P* in the completed table, to find an estimate for the amount of energy produced between 10:00 and 12:00. Give your answer to 2 decimal places.



**(2)** 



Question 7 continued	blank
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	<b>Q7</b>
(Total 6 marks)	



**8.** A sequence  $a_1, a_2, a_3, \dots$  is defined by

$$a_{n+1} = 2(a_n + 3)^2 - 7$$
  
 $a_1 = p - 3$ 

where p is a constant.

(a) Find an expression for  $a_2$  in terms of p, giving your answer in simplest form.

**(1)** 

Given that  $\sum_{n=1}^{3} a_n = p + 15$ 

(b) find the possible values of  $a_2$ 

**(6)** 


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Question 8 continued	



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Question 8 continued		

Question 8 continued		Leave blank
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**9.** A circle *C* has equation

$$(x-k)^2 + (y-2k)^2 = k+7$$

where k is a positive constant.

- (a) Write down, in terms of k,
  - (i) the coordinates of the centre of C,
  - (ii) the radius of C.

**(2)** 

Given that the point P(2,3) lies on C

- (b) (i) show that  $5k^2 17k + 6 = 0$ 
  - (ii) hence find the possible values of k.

(3)

The tangent to the circle at P intersects the x-axis at point T.

Given that k < 2

(c) calculate the exact area of triangle OPT.

**(5)** 





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(Total 10 mark	



## 10. In this question you must show detailed reasoning.

Owen wants to train for 12 weeks in preparation for running a marathon.

During the 12-week period he will run every Sunday and every Wednesday.

- On Sunday in week 1 he will run 15 km
- On Sunday in week 12 he will run 37 km

He considers two different 12-week training plans.

In training plan A, he will increase the distance he runs each Sunday by the same amount.

(a) Calculate the distance he will run on Sunday in week 5 under training plan A.

**(3)** 

In training plan B, he will increase the distance he runs each Sunday by the same percentage.

(b) Calculate the distance he will run on Sunday in week 5 under training plan B. Give your answer in km to one decimal place.

**(3)** 

Owen will also run a fixed distance, x km, each Wednesday over the 12-week period.

Given that

- x is an integer
- the total distance that Owen will run on Sundays and Wednesdays over the 12 weeks will not exceed 360 km
- (c) (i) find the maximum value of x, if he uses training plan A,

(ii)	find the	maximum	value of v	if he use	e training	nlan R
(11)	- una me	шахшшш	value or x	. II ne use	s training i	. מ מומומ

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		Q1
	(Total 11 marks)	
T END	TOTAL FOR PAPER IS 75 MARKS	