Please check the examination details belo	ow before enter	ring your candidate	information
Candidate surname		Other names	
Centre Number Candidate Nu	ımber		
Pearson Edexcel Inter	nation	al Advan	ced Level
<b>Time</b> 1 hour 30 minutes	Paper reference	WMA	12/01
Mathematics			
International Advanced Su	ıbsidiarv	v/Advanced	d Level
Pure Mathematics P2	,	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	
i die Mathematics i 2			
You must have: Mathematical Formulae and Statistica	ıl Tables (Yel	llow), calculator	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.

Turn over ▶







1. The first three terms, in ascending powers of x, of the binomial expansion of  $(1 + kx)^{16}$  are

1, 
$$-4x$$
 and  $px^2$ 

where k and p are constants.

- (a) Find, in simplest form,
  - (i) the value of k
  - (ii) the value of p

(3)

$$g(x) = \left(2 + \frac{16}{x}\right) (1 + kx)^{16}$$

Using the value of k found in part (a),

(b) find the term in  $x^2$  in the expansion of g(x).

(3)

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**(3)** 

2. A sequence is defined by

$$u_1 = 6$$
$$u_{n+1} = ku_n + 3$$

where k is a positive constant.

(a) Find, in terms of k, an expression for  $u_3$ 

(2)

Given that  $\sum_{n=1}^{3} u_n = 117$ 

(b) find the value of k.



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**3.** 

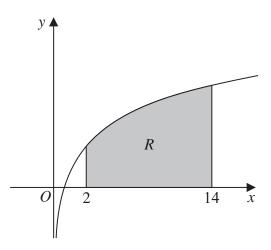


Figure 1

Figure 1 shows a sketch of part of the curve with equation  $y = \log_{10} x$ 

The region R, shown shaded in Figure 1, is bounded by the curve, the line with equation x = 2, the x-axis and the line with equation x = 14

Using the trapezium rule with four strips of equal width,

(a) show that the area of R is approximately 10.10

**(3)** 

(b) Explain how the trapezium rule could be used to obtain a more accurate estimate for the area of R.

**(1)** 

(c) Using the answer to part (a) and making your method clear, estimate the value of

$$(i) \quad \int_{2}^{14} \log_{10} \sqrt{x} \, \mathrm{d}x$$

(ii) 
$$\int_{2}^{14} \log_{10} 100 x^3 \, \mathrm{d}x$$

**(4)** 

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4.		$f(x) = (x^2 - 2)(2x - 3) - 21$	
	(a)	State the value of the remainder when $f(x)$ is divided by $(2x-3)$	(1)
	(b)	Use the factor theorem to show that $(x-3)$ is a factor of $f(x)$	(2)
	(c)	Hence,	
		(i) factorise $f(x)$	
		(ii) show that the equation $f(x) = 0$ has only one real root.	(5)

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5. A company that owned a silver mine

- extracted 480 tonnes of silver from the mine in year 1
- extracted 465 tonnes of silver from the mine in year 2
- extracted 450 tonnes of silver from the mine in year 3

and so on, forming an arithmetic sequence.

(a) Find the mass of silver extracted in year 14

**(2)** 

After a total of 7770 tonnes of silver was extracted, the company stopped mining.

Given that this occurred at the end of year N,

(b) show that

$$N^2 - 65N + 1036 = 0$$

**(3)** 

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**6.** (i) The circle  $C_1$  has equation

$$x^2 + y^2 + 10x - 12y = k$$
 where k is a constant

(a) Find the coordinates of the centre of  $C_1$ 

**(2)** 

(b) State the possible range in values for k.

**(2)** 

(ii) The point P(p,0), the point Q(-2,10) and the point R(8,-14) lie on a different circle,  $C_2$ 

Given that

- *p* is a positive constant
- QR is a diameter of  $C_2$

find the exact value of p.

**(4)** 


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7. (i) A geometric sequence has first term 4 and common ratio 6 Given that the  $n^{\text{th}}$  term is greater than  $10^{100}$ , find the minimum possible value of n.

Leave blank

(ii) A different geometric sequence has first term a and common ratio r.

Given that

- the second term of the sequence is -6
- the sum to infinity of the series is 25
- (a) show that

$$25r^2 - 25r - 6 = 0$$

**(3)** 

(b) Write down the solutions of

$$25r^2 - 25r - 6 = 0$$

**(1)** 

Hence,

(c) state the value of r, giving a reason for your answer,

**(1)** 

(d) find the sum of the first 4 terms of the series.

**(2)** 



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Question 7 continued	



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8. In this question you must show all stages of your working.

Solutions relying entirely on calculator technology are not acceptable.

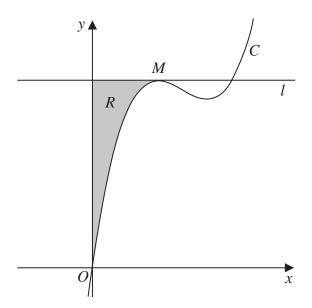


Figure 2

Figure 2 shows a sketch of part of the curve C with equation

$$y = \frac{4}{3}x^3 - 11x^2 + kx$$
 where *k* is a constant

The point M is the maximum turning point of C and is shown in Figure 2.

Given that the x coordinate of M is 2

(a) show that k = 28

(3)

(b) Determine the range of values of x for which y is increasing.

**(2)** 

The line l passes through M and is parallel to the x-axis.

The region R, shown shaded in Figure 2, is bounded by the curve C, the line l and the y-axis.

(c) Find, by algebraic integration, the exact area of R.

**(5)** 

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Question 8 continued	
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9.	(a) Prove that for all positive values of $x$ and $y$ , $x + y \qquad -$	
	$\frac{x+y}{2} \geqslant \sqrt{xy}$	
		(3)
	(b) Prove by counter-example that this inequality does not hold when $x$ and $y$	are
	both negative.	(1)

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**(5)** 

10. In this question you must show all stages of your working.

Solutions relying entirely on calculator technology are not acceptable.

(i) Solve, for 
$$-\frac{\pi}{2} < x < \frac{\pi}{2}$$

$$\tan^2\left(2x + \frac{\pi}{4}\right) = 3$$

(ii) Solve, for  $0 < \theta < 360^{\circ}$ 

$$(2\sin\theta - \cos\theta)^2 = 1$$

giving your answers, as appropriate, to one decimal place.

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(Total 10 marks)

TOTAL FOR PAPER IS 75 MARKS

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Question 10 continued