

Please check the examination details below before entering your candidate information

Candidate surname

Other names

Centre Number

Candidate Number

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## Pearson Edexcel International Advanced Level

Time 1 hour 30 minutes

Paper  
reference

**WMA12/01**

### Mathematics

International Advanced Subsidiary/Advanced Level  
Pure Mathematics P2

**You must have:**

Mathematical Formulae and Statistical Tables (Yellow), 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 ►

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

$$1, -4x \text{ and } px^2$$

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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**Question 1 continued**

Lined writing area for the answer to Question 1.

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Q1

**(Total 6 marks)**



P 6 9 1 9 9 A 0 3 3 2

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  $k$ . (3)

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**Question 2 continued**

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Lined writing area for the answer to Question 2.

**(Total 5 marks)**

Q2



3.

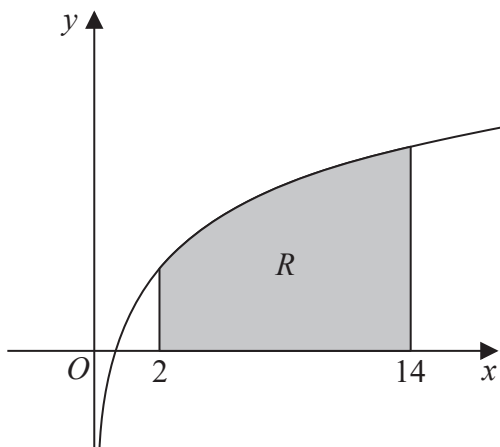


Figure 1

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)  $\int_2^{14} \log_{10} \sqrt{x} \, dx$

(ii)  $\int_2^{14} \log_{10} 100x^3 \, dx$

(4)

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**Question 3 continued**

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**(Total 8 marks)**

**Q3**



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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**Question 4 continued**

Lined writing area for the response to Question 4.

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**Question 4 continued**

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Lined writing area for the answer to Question 4.

Q4

(Total 8 marks)



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

$$N^2 - 65N + 1036 = 0 **(3)**$$

(c) Hence, state the value of  $N$ . **(1)**

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**Question 5 continued**

Lined writing area for the answer to Question 5.

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(Total 6 marks)

Q5



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

$$x^2 + y^2 + 10x - 12y = k \quad \text{where } k \text{ is a constant}$$

- (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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### Question 6 continued

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Q6

(Total 8 marks)



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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  $n$ . (3)

(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

$$25r^2 - 25r - 6 = 0 \tag{3}$$

(b) Write down the solutions of

$$25r^2 - 25r - 6 = 0 \tag{1}$$

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

Solutions relying entirely on calculator technology are not acceptable.

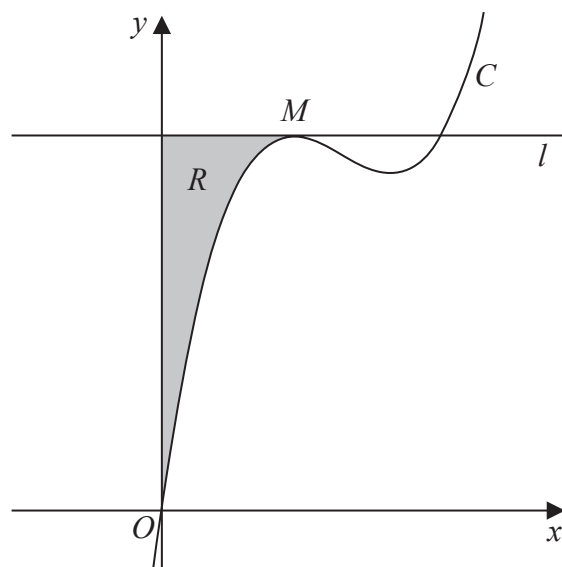


Figure 2

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

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

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

Lined area for writing the answer to Question 8 continued.

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**Question 8 continued**

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**Q8**

**(Total 10 marks)**





Question 9 continued

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Lined writing area for the question response.

(Total 4 marks)

Q9







