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**Pearson Edexcel International Advanced Level**

**Tuesday 13 May 2025**

Morning (Time: 1 hour 30 minutes) **Paper reference** **WMA12/01A**

**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.
- If you change your mind about an answer, cross it out and put your new answer and any working underneath.

Turn over ►

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1. Given that  $a$ ,  $b$  and  $c$  are positive integers such that

- $c = a^2 - 1$
- $a + b + c = 20$

prove, by exhaustion, that the product  $abc$  is always a multiple of 6

You may use the table below to illustrate your answer.

(3)

You may not need to use all rows of this table.

| $a$ | $b$ | $c$ | $abc$ |
|-----|-----|-----|-------|
|     |     |     |       |
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Question 1 continued

Lined area for writing the answer to Question 1.

(Total for Question 1 is 3 marks)



2. A geometric series has first term  $a$  and common ratio  $r$ .

Given that

- the third term in the series is 64
- the sixth term in the series is  $-8$

(a) show that  $r = -\frac{1}{2}$  (2)

(b) find the sum to infinity of the series. (4)



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Question 2 continued

Lined area for writing the answer to Question 2.

(Total for Question 2 is 6 marks)



3.

$$f(x) = (3x^2 - 4x - 5)(x - k) - 5$$

where  $k$  is a constant.

- (a) Deduce the value of the remainder when  $f(x)$  is divided by  $(x - k)$  (1)

Given that the remainder when  $f(x)$  is divided by  $(x + 2)$  is 25

- (b) show that the value of  $k$  is  $-4$  (2)

- (c) Hence find the quotient and remainder when  $f(x)$  is divided by  $(3x - 1)$  (4)



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Question 3 continued

Lined area for writing the answer to Question 3.



Question 3 continued

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Question 3 continued

Lined area for writing the answer to Question 3.

(Total for Question 3 is 7 marks)



4.

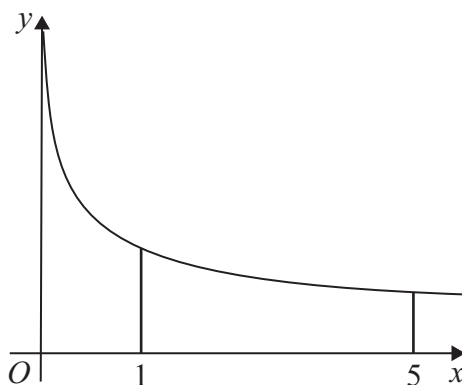


Figure 1

Figure 1 shows a sketch of part of the curve with equation

$$y = \log_3(x+1) - \log_3 x$$

The point  $P(a, 4)$  lies on the curve.

- (a) Find the exact value of the constant  $a$ .

*(Solutions relying on calculator technology are not acceptable.)*

(4)

- (b) Use the trapezium rule with 4 strips of equal width to estimate the value of

$$\int_1^5 (\log_3(x+1) - \log_3 x) dx$$

giving the answer in the form  $\log_3 k$ , where  $k$  is a constant to be found.

(4)

- (c) Explain how the trapezium rule could be used to obtain a more accurate estimate for

$$\int_1^5 (\log_3(x+1) - \log_3 x) dx$$

(1)



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Question 4 continued

Lined area for writing the answer to Question 4.



Question 4 continued

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Question 4 continued

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(Total for Question 4 is 9 marks)



5.

In this question you must show all stages of your working.  
Solutions relying on calculator technology are not acceptable.

The sequence  $u_1, u_2, u_3, \dots$  is defined by

$$u_{n+1} = 1 - \frac{1}{u_n}$$

$$u_1 = 4$$

(a) Show that this is a periodic sequence of order 3

(3)

(b) Find the value of

$$\sum_{n=1}^{180} (5n + 3 + u_n)$$

(4)



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Question 5 continued

Lined area for writing the answer to Question 5.

(Total for Question 5 is 7 marks)



6. In this question you must show all stages of your working.  
Solutions relying on calculator technology are not acceptable.

(i) Given that  $\theta$  is measured in degrees and

- $\cos \theta = \frac{1}{\sqrt{5}}$
- $180^\circ < \theta < 360^\circ$

use trigonometric identities to find the exact value of

(a)  $\sin \theta$

(b)  $\tan \theta$

giving the answers as fully simplified surds where appropriate.

(4)

(ii)

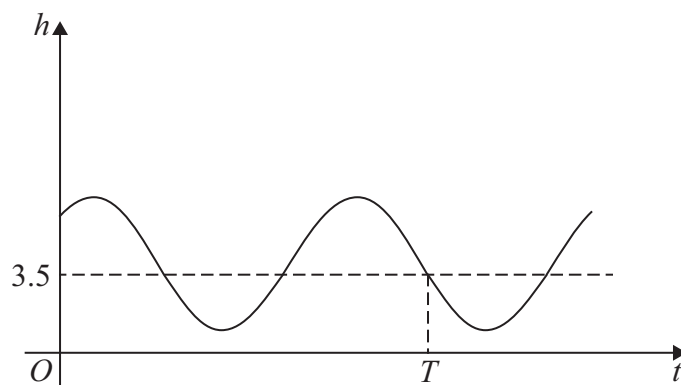


Figure 2

The height of sea water,  $h$  metres, on a harbour wall,  $t$  hours after midnight on a particular day is given by

$$h = 4 + 3 \cos(30t - 40)^\circ \quad 0 \leq t < 24$$

A sketch of  $h$  against  $t$  is shown in Figure 2.

(a) Find the minimum height of sea water on the harbour wall.

(1)

(b) Find the exact time of day when this minimum height **first** occurs.

(3)

When  $t = T$ , as shown in Figure 2, a boat enters the harbour when the height of sea water on the harbour wall is 3.5 m.

(c) Use Figure 2 and the given equation to find the value of  $T$  to 2 decimal places.

(4)



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Question 6 continued

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Question 6 continued

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Question 6 continued

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(Total for Question 6 is 12 marks)



7.

**In this question you must show all stages of your working. Solutions relying entirely on calculator technology are not acceptable.**

The binomial expansion, in ascending powers of  $x$ , of  $(1 + kx)^n$  is

$$1 - 24x + 270x^2 + px^3 + \dots$$

where  $k$  and  $p$  are constants and  $n$  is an integer greater than 1

- (a) Use this information to set up and solve two simultaneous equations to find the value of  $k$  and the value of  $n$ .

(6)

- (b) Hence find the value of  $p$ .

(2)

[illegible]

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Question 7 continued

Lined area for writing the answer to Question 7.



Question 7 continued

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Question 7 continued

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(Total for Question 7 is 8 marks)



**8.**

**In this question you must show all stages of your working. Solutions relying entirely on calculator technology are not acceptable.**

A curve  $C$  has equation  $y = f(x)$  where  $f(x)$  is a polynomial in  $x$ .

Given

$$f'(x) = 2(3x - 2)(x + 5)$$

- (a) deduce the range of values of  $x$  for which  $y$  is decreasing. (2)

Given further that  $C$  cuts the  $x$ -axis at  $\frac{7}{2}$

- (b) state a factor of  $f(x)$ , giving the answer in the form  $(Ax + B)$  where  $A$  and  $B$  are integers.

- (c) Hence find an expression for  $f(x)$  in a fully factorised form. (6)

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Question 8 continued

Lined area for writing the answer to Question 8.



Question 8 continued

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Question 8 continued

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(Total for Question 8 is 9 marks)





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Question 9 continued

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(Total for Question 9 is 5 marks)



10.

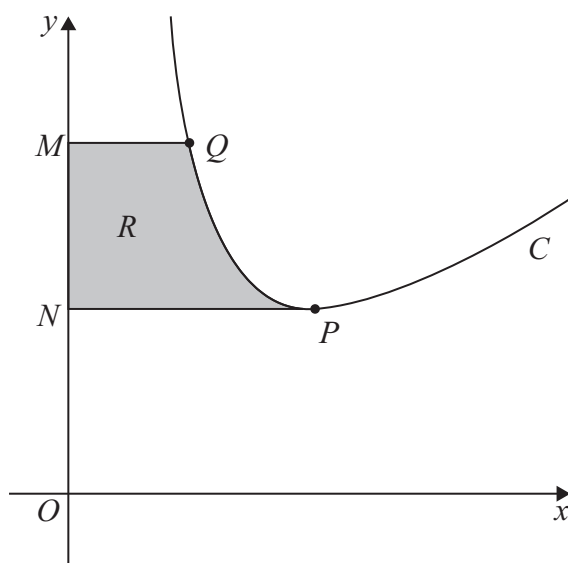


Figure 3

**In this question you must show all stages of your working.**  
**Solutions relying entirely on calculator technology are not acceptable.**

Figure 3 shows a sketch of the curve  $C$  with equation

$$y = 2x + \frac{64}{x^2} - 3 \quad x > 0$$

The point  $P$ , shown in Figure 3, is the stationary point on  $C$ .

(a) Show, using calculus, that the  $x$  coordinate of  $P$  is 4

(4)

The point  $Q$  lies on  $C$  and has  $x$  coordinate 2

The line segments  $MQ$  and  $NP$ , shown in Figure 3, are parallel to the  $x$ -axis.

The region  $R$ , shown shaded in Figure 3, is bounded by  $C$ , the  $y$ -axis and line segments  $MQ$  and  $NP$ .

(b) Use algebraic integration to find the exact area of  $R$ .

You must make your method clear.

(5)

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Question 10 continued

Lined area for writing the answer to Question 10.



**Question 10 continued**

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**(Total for Question 10 is 9 marks)**

**TOTAL FOR PAPER IS 75 MARKS**

