Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

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 ▶

P 8 3 1 7 2 A 0 1 3 2

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

(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

(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)

Question 3 continued

Question 3 continued

Question 3 continued

(Total for Question 3 is 7 marks)

4:

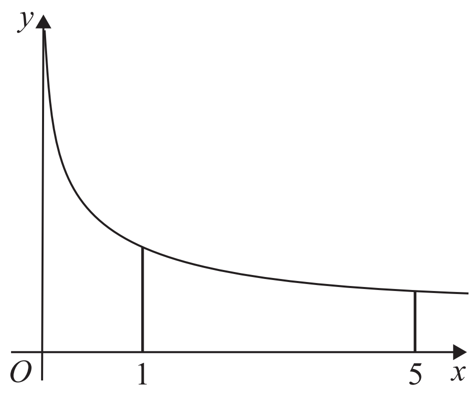

Figure 1

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

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

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

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

(1)

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Question 4 continued

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Question 4 continued

(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 $u_1, u_2, u_3, \ldots$ 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

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

(4)

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Question 5 continued

(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 θ is measured in degrees and

- $\cos\theta = \dfrac{1}{\sqrt{5}}$
- $180° < \theta < 360°$

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)

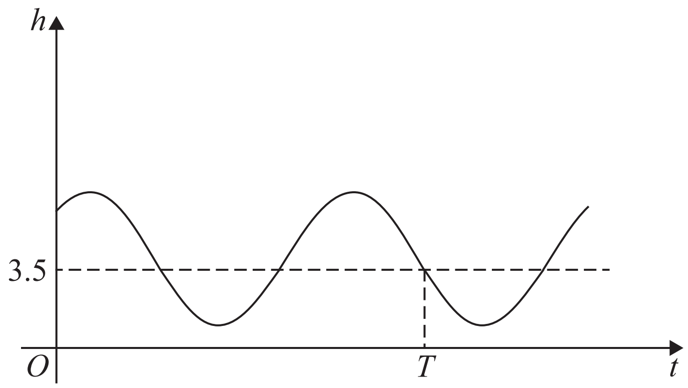

Figure 2

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

$$h = 4 + 3\cos(30t - 40)° \qquad 0 \leqslant t < 24$$

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

Question 6 continued

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Question 6 continued

(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

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

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)

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Question 7 continued

Question 7 continued

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Question 7 continued

(Total for Question 7 is 8 marks)

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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.

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

Given

$$\mathrm{f}'(x) = 2(3x - 2)(x + 5)$$

(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 $\mathrm{f}(x)$, giving the answer in the form $(Ax + B)$ where A and B are integers.

(1)

(c) Hence find an expression for $\mathrm{f}(x)$ in a fully factorised form.

(6)

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Question 8 continued

Question 8 continued

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Question 8 continued

(Total for Question 8 is 9 marks)

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9: The circle C

- has a centre which lies on the x-axis
- touches the y-axis
- passes through the point (5, 6)

(a) On Diagram 1, sketch a graph of C.

(1)

(b) Find an equation for C.

(4)

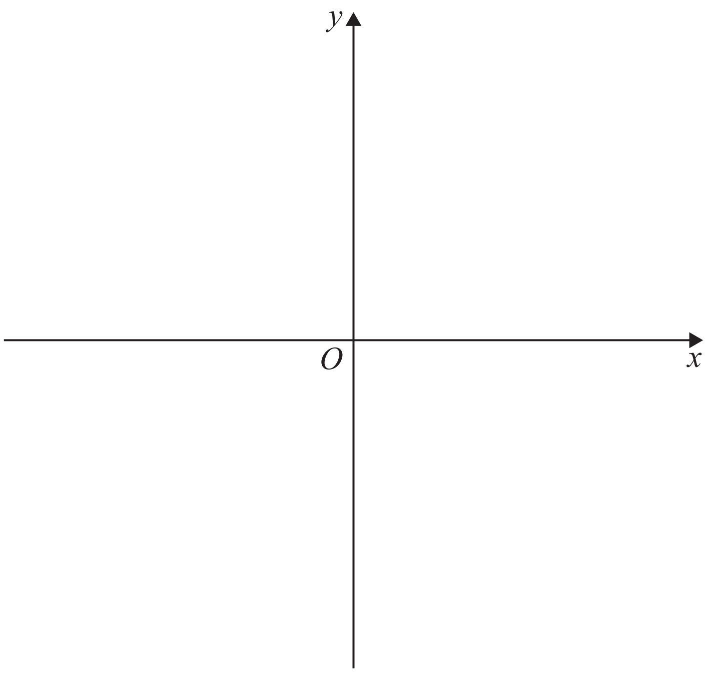

Diagram 1

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Question 9 continued

(Total for Question 9 is 5 marks)

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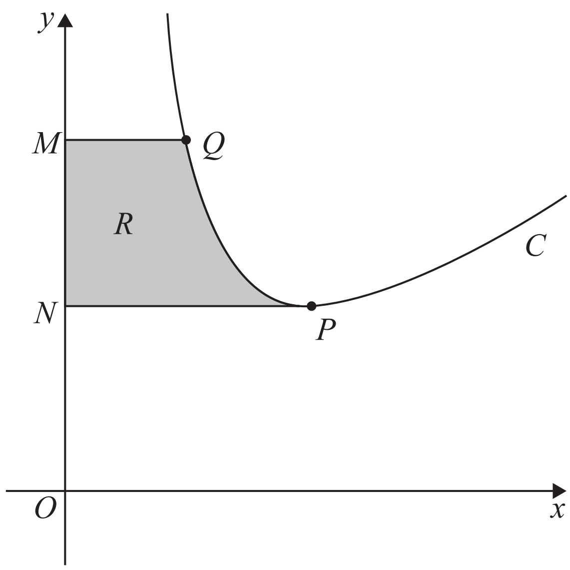

Figure 3

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

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

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

Question 10 continued

(Total for Question 10 is 9 marks)

TOTAL FOR PAPER IS 75 MARKS

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