Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

Pearson Edexcel International Advanced Level

Thursday 22 January 2026

Morning (Time: 1 hour 30 minutes)

Paper reference **WMA14/01**

Mathematics

International Advanced Level
Pure Mathematics P4

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 9 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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Pearson

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

Given that the binomial expansion of $(1 + ax)^n$, in ascending powers of x, is

$$1 - 4x + \frac{24}{5}x^2 + px^3 + \ldots$$

where a, n and p are constants,

(a) find the value of a and the value of n.

(5)

Hence

(b) find the value of p,

(2)

(c) state the set of values of x for which the expansion is valid.

(1)

Question 1 continued

Question 1 continued

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Question 1 continued

(Total for Question 1 is 8 marks)

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

Using algebraic integration, find the exact value of

$$\int_{2}^{2e^2} x^3 \ln\left(\frac{1}{2}x\right) \mathrm{d}x$$

giving the answer in simplest form.

(5)

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Question 2 continued

(Total for Question 2 is 5 marks)

3. (a) Factorise $x^2 - 4y^2$

(1)

(b) Use proof by contradiction to prove that there are no positive integers x and y such that

$$x^2 - 4y^2 = 27$$

(4)

Question 3 continued

(Total for Question 3 is 5 marks)

4. (a) Use the substitution $u = e^x + 4$ to show that

$$\int_0^{\ln 6} \frac{2e^x + 3}{e^x + 4}\,dx = \int_a^b \frac{cu + d}{u(u-4)}\,du$$

where a, b, c and d are constants to be found.

(3)

(b) Hence, using algebraic integration, show that

$$\int_0^{\ln 6} \frac{2e^x + 3}{e^x + 4}\,dx = P\ln 2 + Q\ln 3$$

where P and Q are constants to be found.

(6)

Question 4 continued

Question 4 continued

Question 4 continued

(Total for Question 4 is 9 marks)

5.

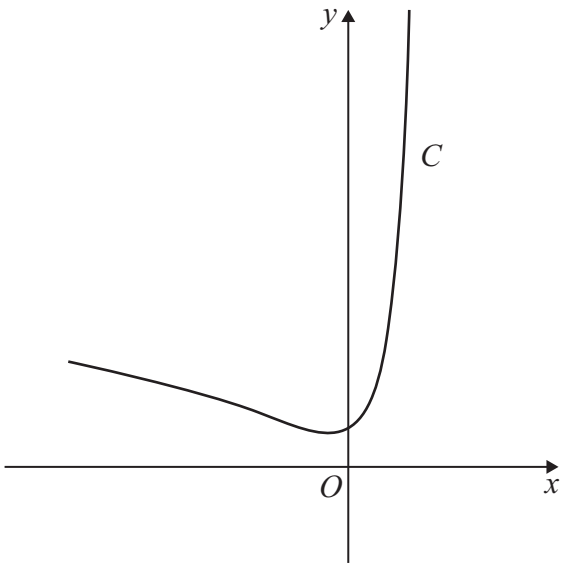

Figure 1

The curve C, shown in Figure 1, has parametric equations

$$x = \frac{4t - 5}{2t + 1} \qquad y = 2t^2 - 4t + 4 \qquad t \geqslant 0$$

The point P lies on C and has parameter $t = 3$

(a) Find the coordinates of P.

(2)

(b) Find $\dfrac{\mathrm{d}y}{\mathrm{d}x}$ in terms of t, writing the answer in simplest form.

(4)

(c) Hence find the equation of the tangent to C at P. Write the answer in the form $y = mx + c$, where m and c are constants.

(2)

Given that

- the Cartesian equation of C is $y = \mathrm{f}(x)$
- the function f is defined for all values of x on C

(d) (i) find the domain of f

(ii) find the range of f

(3)

Question 5 continued

Question 5 continued

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Question 5 continued

(Total for Question 5 is 11 marks)

6. With respect to a fixed origin O, the line l_1 has equation

$$\mathbf{r} = \begin{pmatrix} -3 \\ 0 \\ 5 \end{pmatrix} + \lambda \begin{pmatrix} 2 \\ 1 \\ -3 \end{pmatrix}$$

where λ is a scalar parameter.

The point P lies on l_1

Given that P is the point on l_1 that is nearest O,

(a) find the coordinates of P.

(4)

With respect to the same fixed origin O, the line l_2 has equation

$$\mathbf{r} = \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix} + \mu \begin{pmatrix} 4 \\ a \\ -2 \end{pmatrix}$$

where a is a constant and μ is a scalar parameter.

Given that l_1 and l_2 intersect at the point Q,

(b) find the value of a,

(4)

(c) find the coordinates of Q.

(2)

Question 6 continued

Question 6 continued

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Question 6 continued

(Total for Question 6 is 10 marks)

7.

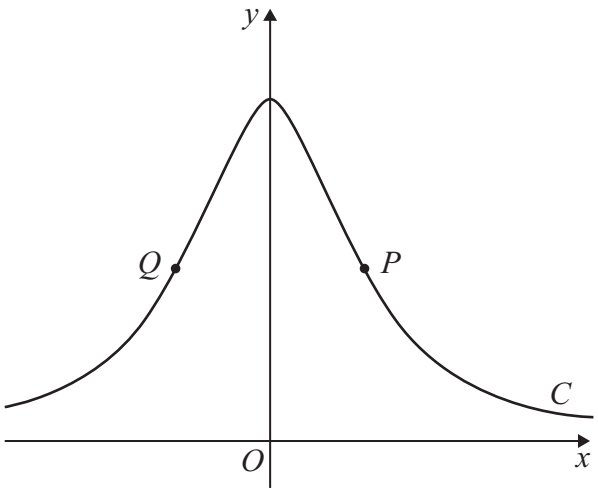

Figure 2

The curve C, shown in Figure 2 has equation

$$x^2 \tan y + \frac{32y^2}{\pi^2} = 11 \qquad 0 < y \leqslant \frac{\pi}{2}$$

The points P and Q, shown in Figure 2, lie on C and have y coordinate $\frac{\pi}{4}$

(a) Find the x coordinate of P and the x coordinate of Q.

(2)

(b) Use algebraic differentiation to find the exact value of $\frac{\mathrm{d}y}{\mathrm{d}x}$ at P.

(5)

(c) Hence, showing your working, find the value of

(the gradient of the tangent to C at P) $\times$ (the gradient of the normal to C at Q)

(2)

Question 7 continued

Question 7 continued

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Question 7 continued

(Total for Question 7 is 9 marks)

8. A large spherical balloon starts to deflate.

The balloon remains spherical whilst deflating.

At time t seconds after the balloon starts to deflate

- the balloon has radius r cm
- the balloon has volume V cm^3

Given that the volume of the balloon is modelled to decrease at a constant rate,

(a) use the model to show that

$$\frac{\mathrm{d}r}{\mathrm{d}t} = -\frac{k}{r^2}$$

where k is a positive constant.

(3)

Given that

- the initial radius of the balloon is 30 cm
- after 24 seconds the radius of the balloon is 12 cm

(b) solve the differential equation in part (a) to find an equation for r in terms of t.

(5)

Given that $V = 0$ when $t = T$

(c) use the model to find the value of T to one decimal place.

(2)

Question 8 continued

Question 8 continued

Question 8 continued

(Total for Question 8 is 10 marks)

9.

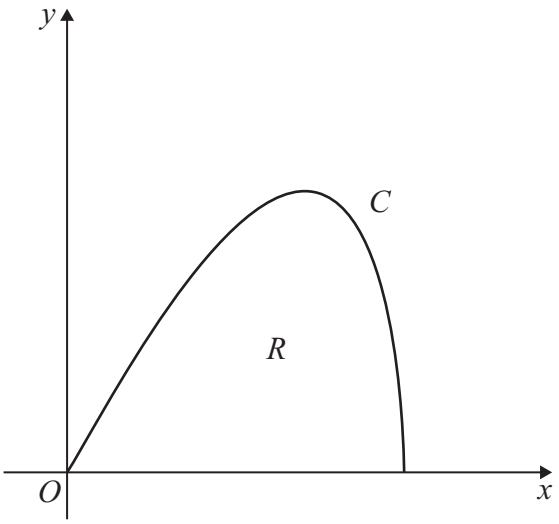

Figure 3

The curve C, shown in Figure 3, has parametric equations

$$x = 6\sin t \qquad y = 5\sin 2t \qquad 0 \leqslant t \leqslant k$$

where k is a constant.

The region R, also shown in Figure 3, is bounded by C and the x-axis.

This region is rotated through 2π radians about the x-axis to form a solid.

(a) Show that the volume, V, of this solid is given by

$$V = P\int_0^k \sin^m t \cos^n t \, \mathrm{d}t$$

where k, P, m and n are constants to be found.

(4)

(b) Hence, using algebraic integration, find the exact value of V.

(4)

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Question 9 continued

Question 9 continued

(Total for Question 9 is 8 marks)

TOTAL FOR PAPER IS 75 MARKS

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