Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

Pearson Edexcel International GCSE

Tuesday 10 June 2025

Afternoon (Time: 2 hours)

Paper reference **4PM1/02**

Further Pure Mathematics

PAPER 2

Calculators may be used.

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Without sufficient working, correct answers may be awarded no marks.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*
- You must **NOT** write anything on the formulae page.
  Anything you write on the formulae page will gain NO credit.

Information

- The total mark for this paper is 100.
- 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.
- Check your answers if you have time at the end.

Turn over ▶

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Pearson

International GCSE in Further Pure Mathematics Formulae sheet

Mensuration

Surface area of sphere = $4\pi r^2$

Curved surface area of cone = $\pi r \times$ slant height

Volume of sphere = $\frac{4}{3}\pi r^3$

Series

Arithmetic series

Sum to n terms, $S_n = \frac{n}{2}[2a + (n-1)d]$

Geometric series

Sum to n terms, $S_n = \frac{a(1-r^n)}{(1-r)}$

Sum to infinity, $S_\infty = \frac{a}{1-r} \quad |r| < 1$

Binomial series

$$(1+x)^n = 1 + nx + \frac{n(n-1)}{2!}x^2 + \ldots + \frac{n(n-1)\ldots(n-r+1)}{r!}x^r + \ldots \quad \text{for} \quad |x| < 1, n \in \mathbb{Q}$$

Calculus

Quotient rule (differentiation)

$$\frac{\mathrm{d}}{\mathrm{d}x}\left(\frac{\mathrm{f}(x)}{\mathrm{g}(x)}\right) = \frac{\mathrm{f}'(x)\mathrm{g}(x) - \mathrm{f}(x)\mathrm{g}'(x)}{[\mathrm{g}(x)]^2}$$

Trigonometry

Cosine rule

In triangle ABC: $a^2 = b^2 + c^2 - 2bc\cos A$

$\tan\theta = \frac{\sin\theta}{\cos\theta}$

$\sin(A+B) = \sin A \cos B + \cos A \sin B$ $\quad$ $\sin(A-B) = \sin A \cos B - \cos A \sin B$

$\cos(A+B) = \cos A \cos B - \sin A \sin B$ $\quad$ $\cos(A-B) = \cos A \cos B + \sin A \sin B$

$\tan(A+B) = \frac{\tan A + \tan B}{1 - \tan A \tan B}$ $\quad$ $\tan(A-B) = \frac{\tan A - \tan B}{1 + \tan A \tan B}$

Logarithms

$\log_a x = \frac{\log_b x}{\log_b a}$

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Answer all ELEVEN questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 Solve the equation

$$\sqrt{3}\tan A = 2\sin A \qquad \text{for} \quad 0^\circ \leqslant A \leqslant 360^\circ$$

(5)

(Total for Question 1 is 5 marks)

2 Find the set of values for x for which

(a) $9-3x>11x+2$

(1)

(b) $10x^2+7x<12$

(3)

(c) **both** $9-3x>11x+2$ **and** $10x^2+7x<12$

(1)

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Question 2 continued

(Total for Question 2 is 5 marks)

3 Given that $\frac{a+b\sqrt{5}}{6-2\sqrt{5}} = \frac{9+4\sqrt{5}}{c}$ where a, b and c are prime numbers,

find the value of a, the value of b and the value of c

(5)

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Question 3 continued

(Total for Question 3 is 5 marks)

4 A geometric series G has first term a and common ratio r

The third term of G is 10 and the seventh term of G is 40

Given that the second term of G is negative,

(a) find

(i) the exact value of r

(ii) the value of a

(5)

(b) Explain why G does not have a sum to infinity.

(1)

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Question 4 continued

(Total for Question 4 is 6 marks)

5 In triangle ABC, $AC = 12\text{ cm}$, $BC = 14\text{ cm}$, $AB = x\text{ cm}$ and angle $ABC = 30°$

(a) Show that $x = P\sqrt{3} \pm \sqrt{95}$ where P is a prime number.

(5)

(b) Hence or otherwise, find in cm^2, the difference between the two possible areas of triangle ABC

Give your answer in the form $m\sqrt{n}$ where m is a prime number and n is an integer.

(3)

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Question 5 continued

(Total for Question 5 is 8 marks)

6

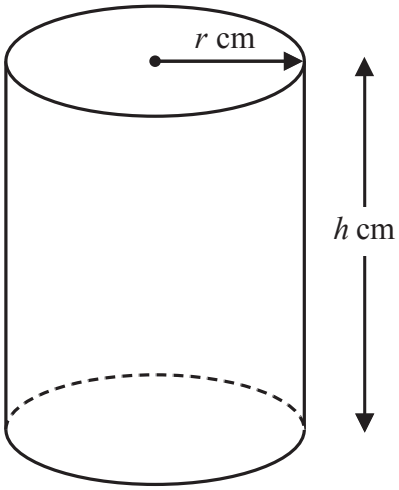

Diagram **NOT** accurately drawn

Figure 1

Figure 1 shows a solid right circular cylinder with radius r cm and height h cm

The total surface area of the cylinder is 700π cm^2

The volume of the cylinder is V cm^3

(a) Show that $V = \pi r\left(350 - r^2\right)$

(4)

Given that r can vary and using calculus,

(b) find, in cm to 3 significant figures, the value of r for which V is a maximum. Justify that this value of r gives a maximum value of V

(5)

(c) Find, to 3 significant figures, the height h cm for which V is a maximum.

(1)

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Question 6 continued

(Total for Question 6 is 10 marks)

7 (a) Complete the table of values for $y = \log_3(4-x)+3$ giving your answers to 2 decimal places.

x	0	0.5	1	1.5	2	2.5	3	3.5
y	4.26		4		3.63		3	2.37

(2)

(b) On the grid opposite, draw the graph of $y = \log_3(4-x)+3$ in the interval $0 \leqslant x \leqslant 3.5$

(2)

(c) By drawing a suitable straight line on the grid, obtain an estimate,

to one decimal place, of the root of the equation $3^{2x-5} - (4-x)^3 = 0$ in the interval $0 \leqslant x \leqslant 3.5$

(6)

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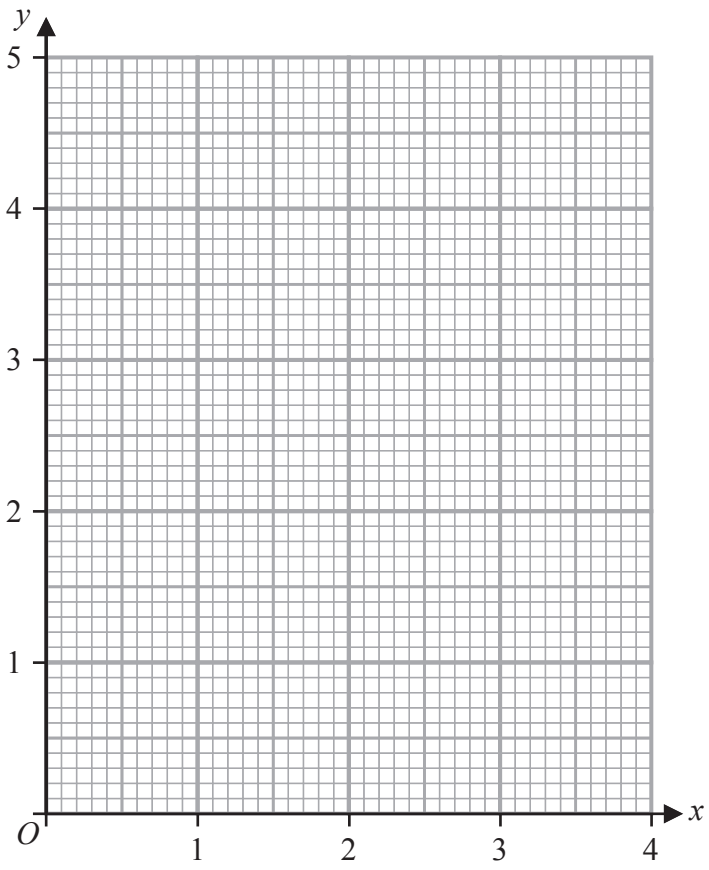
Question 7 continued



Turn over for a spare grid if you need to redraw your graph.

Question 7 continued

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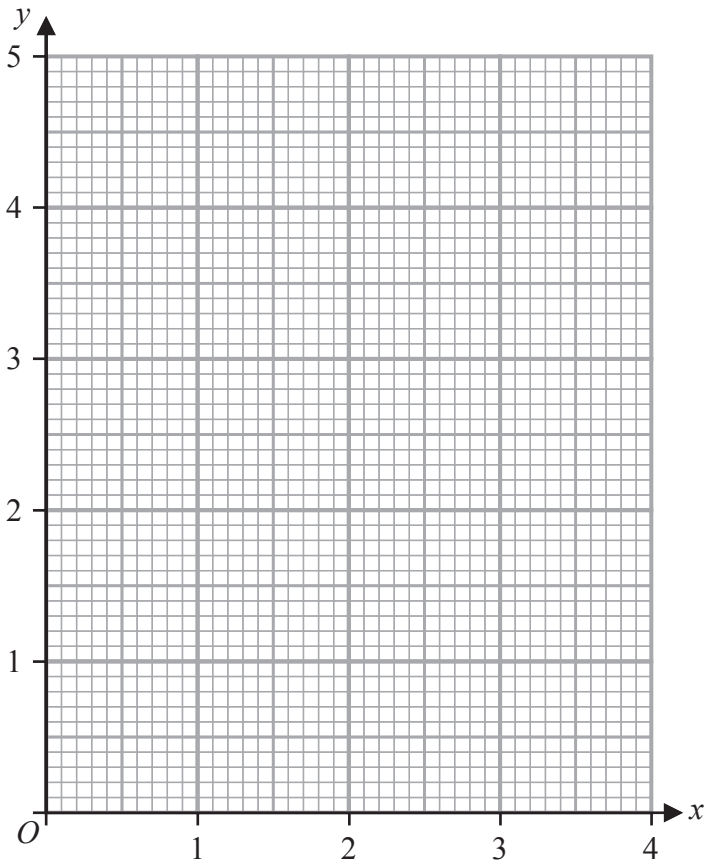
Question 7 continued

Only use this grid if you need to redraw your graph.



(Total for Question 7 is 10 marks)

8

Diagram **NOT** accurately drawn

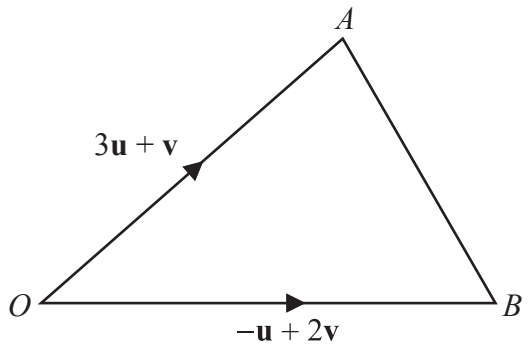


Figure 2

Figure 2 shows triangle OAB with

$$\overrightarrow{OA} = 3\mathbf{u} + \mathbf{v} \qquad \overrightarrow{OB} = -\mathbf{u} + 2\mathbf{v}$$

(a) Find $\overrightarrow{AB}$ as a simplified expression in terms of **u** and **v**

(2)

Point C is such that AC is parallel to OB

Given that $\overrightarrow{OC} = \mu\mathbf{v}$

(b) find the value of μ

(4)

The lines OC and AB intersect at point X

Point D lies on $\overrightarrow{OC}$ such that

area of triangle BOX : area of triangle $BXD = 2 : 3$

Using a vector method,

(c) find $\overrightarrow{BD}$ as a simplified expression in terms of **u** and **v**

(5)

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Question 8 continued

Question 8 continued

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Question 8 continued

(Total for Question 8 is 11 marks)

9

$$y = e^{-4t} \cos 2t$$

(a) Show that $2e^{-4t}\sin 2t = -\frac{dy}{dt} - 4y$

(3)

Given that $\frac{d^2y}{dt^2} + M\frac{dy}{dt} + Ny = 0$ where M and N are integers

(b) find the value of M and the value of N

(5)

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Question 9 continued

Question 9 continued

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Question 9 continued

(Total for Question 9 is 8 marks)

10 A curve C has equation

$$y = \frac{7-x}{2x+3} \qquad x \neq -\frac{3}{2}$$

(a) Write down an equation of the asymptote to C that is

(i) parallel to the y-axis

(ii) parallel to the x-axis

(2)

(b) Find the coordinates of the points of intersection of C with the coordinate axes.

(2)

(c) Using the axes on the opposite page, sketch C, showing clearly the asymptotes and the coordinates of the points where C crosses the coordinate axes.

(3)

C passes through the point A with coordinates $\left(\frac{1}{2}, \frac{13}{8}\right)$

(d) Show that the gradient of C at A is $-\frac{17}{16}$

(3)

C also passes through the point P

Given that the tangent to C at P is parallel to the tangent to C at A

(e) find an equation of the tangent to C at P
Give your answer in the form $ax + by + c = 0$ where a, b and c are integers.

(7)

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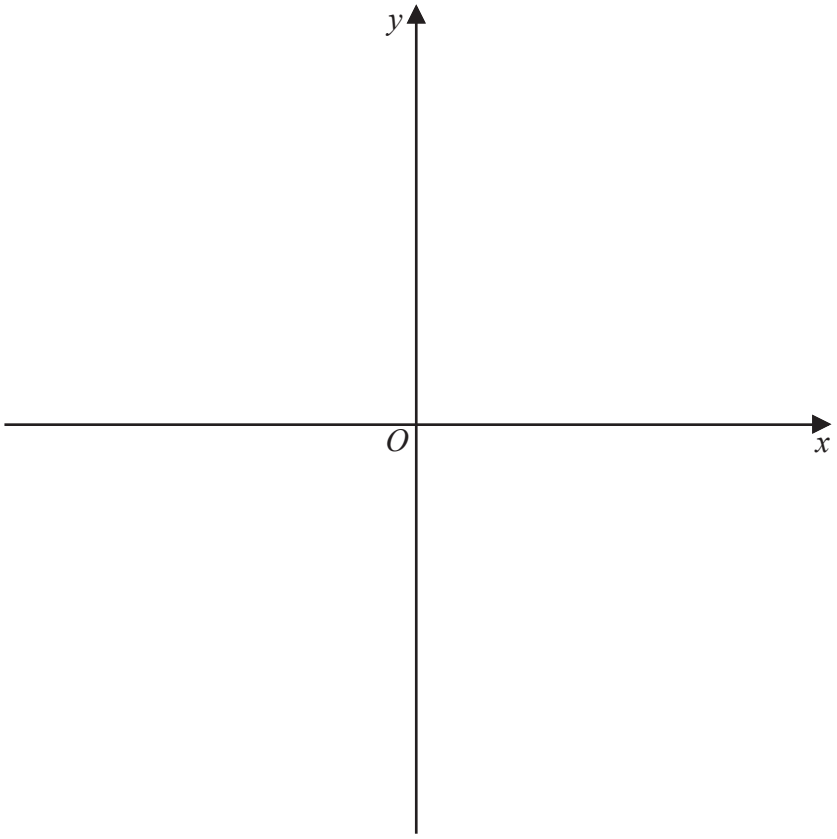
Question 10 continued



Question 10 continued

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Question 10 continued

(Total for Question 10 is 17 marks)

11 (a) Show that $\cos^4\theta - \sin^4\theta = \cos 2\theta$

(4)

(b) Hence, or otherwise, solve the equation

$$8\cos^2\left(2\theta + \frac{\pi}{4}\right) - 3 = 2\cos^4\left(\theta + \frac{\pi}{8}\right) - 2\sin^4\left(\theta + \frac{\pi}{8}\right) \quad \text{for} \quad 0 \leqslant \theta < \pi$$

Give your solutions to 2 decimal places.

(7)

(c) Using calculus, find the exact value of $\int_{\frac{\pi}{16}}^{\frac{\pi}{8}} \left(\cos^4 2x - \sin^4 2x - 8\sin 4x\right) \mathrm{d}x$

Give your answer in the form $a - b\sqrt{2}$ where a and b are rational numbers.

(4)

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Question 11 continued

Question 11 continued

(Total for Question 11 is 15 marks)

TOTAL FOR PAPER IS 100 MARKS

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