

Please check the examination details below before entering your candidate information

Candidate surname					Other names				
Centre Number					Candidate Number				

Pearson Edexcel International GCSE

Tuesday 20 May 2025

Afternoon (Time: 2 hours)

Paper reference **4PM1/01**

Further Pure Mathematics

PAPER 1



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 $= \pi r \times \text{slant height}$

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

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

Calculus**Quotient rule (differentiation)**

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

Trigonometry**Cosine rule**

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

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

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

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

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

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

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

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

Logarithms

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

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Question 1 continued

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(Total for Question 1 is 7 marks)

- 2 The point A has coordinates $(3, 2)$, the point B has coordinates $(8, 3)$ and the point C has coordinates $(4, 7)$

(a) Show that ABC is an isosceles triangle.

(2)

The midpoint of BC is M

(b) Find an equation of the line that passes through A and M

Give your answer in the form $y = mx + c$

(3)

The points A , C and D are collinear such that $AD = kAC$ ($k > 1$)

Given that $\angle ABD = 90^\circ$

(c) find the coordinates of D
Show your working clearly.

(8)

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Question 2 continued

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Question 2 continued

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(Total for Question 2 is 13 marks)

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3

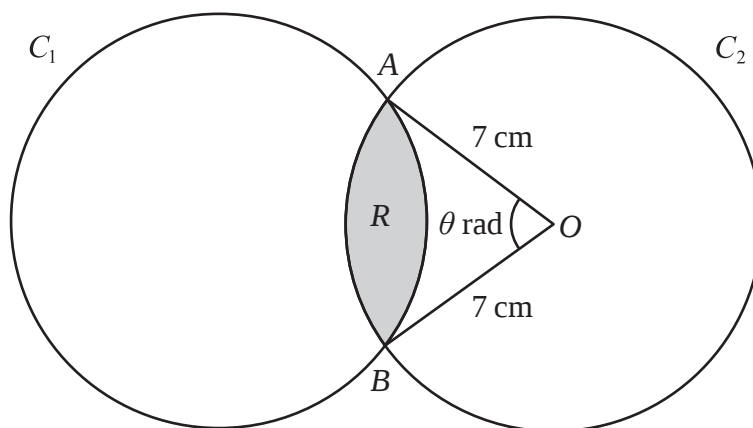


Diagram **NOT**
accurately drawn

Figure 1

Figure 1 shows circle C_1 with radius 7 cm and circle C_2 with centre O and radius 7 cm

The circles C_1 and C_2 intersect at the point A and at the point B

The size of angle AOB is θ radians

The perimeter of the region R shown shaded in Figure 1 is $\frac{28\pi}{9}$ cm

(a) Find the exact value of θ

(2)

(b) Find the area, in cm^2 to 3 significant figures, of the region R

(4)

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Question 3 continued

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(Total for Question 3 is 6 marks)

4 (a) On the grid opposite, draw the graph of the line with equation

(i) $3x + 2y = 18$

(ii) $x + 3y - 6 = 0$

(iii) $y = 3x$

(3)

(b) Show, by shading on the grid, the region R defined by the inequalities

$3x + 2y \leq 18$

$x + 3y - 6 \geq 0$

$y \leq 3x$

(1)

For all points in R , with coordinates (x, y)

$$P = 2x - y$$

(c) find the least value of P

(4)

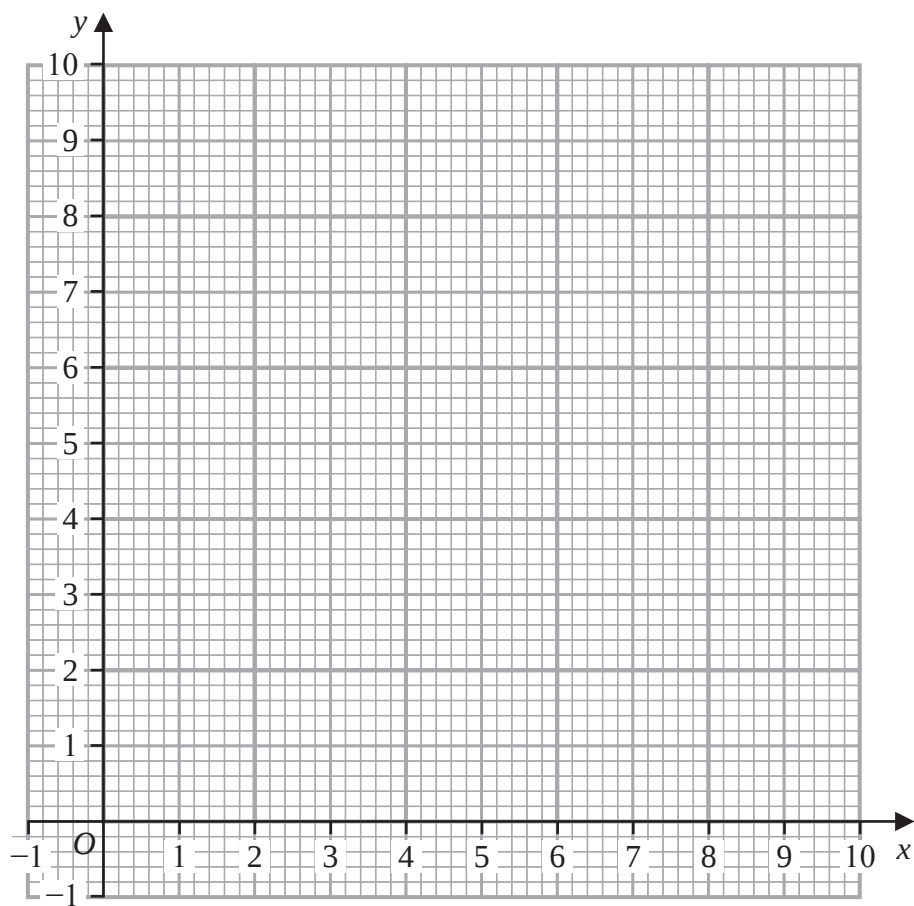
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Question 4 continued



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



Question 4 continued

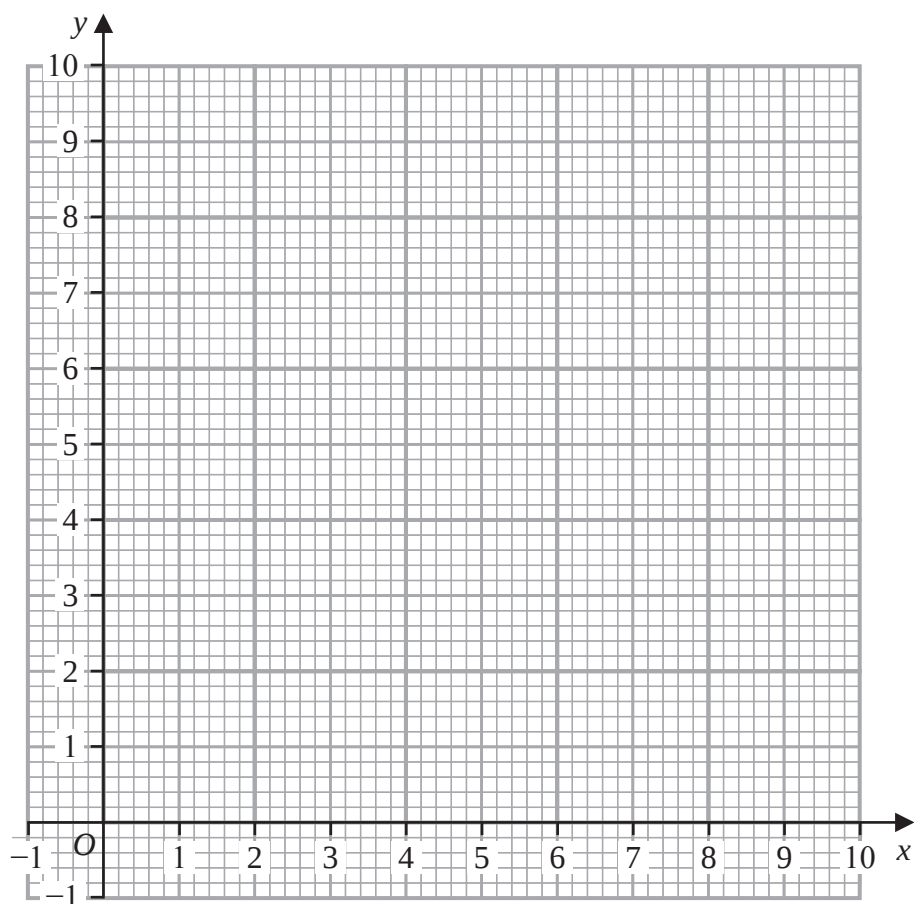
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Only use this grid if you need to redraw your graph.



- 5 (a) Show that $(\alpha + \beta)^3 - 3\alpha\beta(\alpha + \beta) = \alpha^3 + \beta^3$ (2)

The quadratic equation $2x^2 - 6x - 7 = 0$ has roots α and β

Without solving the equation

- (b) form a quadratic equation, with integer coefficients, which has roots $\frac{\alpha^2}{\beta}$ and $\frac{\beta^2}{\alpha}$ (6)

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Question 5 continued

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(Total for Question 5 is 8 marks)

6 (a) Show that $\sqrt{4-x} = A\left(1-\frac{x}{B}\right)^{\frac{1}{2}}$ where A and B are integers to be found. (2)

(b) Hence expand $\sqrt{4-x}$ in ascending powers of x up to and including the term in x^3
Give each coefficient as an exact fraction in its lowest terms. (3)

(c) Use your expansion with a suitable value of x to obtain an estimate of $\frac{\sqrt{305}}{10}$
Give your answer correct to 5 decimal places. (3)

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Question 6 continued

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(Total for Question 6 is 8 marks)

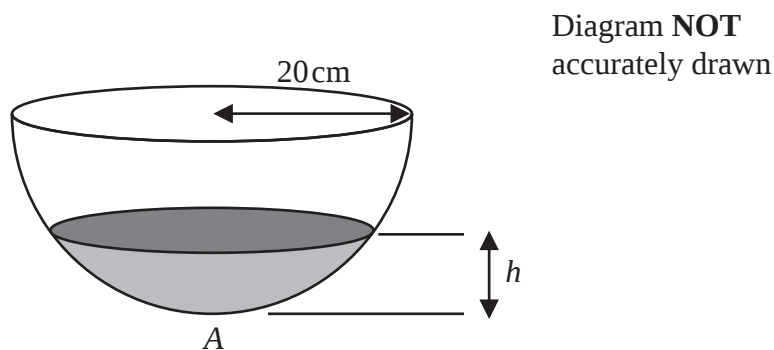


Figure 2

Figure 2 shows a hollow hemisphere with radius 20 cm

The hemisphere contains liquid, which is dripping out of a small hole at the lowest point A at a constant rate of $k \text{ cm}^3/\text{s}$

At time t seconds after the liquid starts to drip from the hemisphere, the height of the liquid is h cm above A

The volume $V \text{ cm}^3$ of liquid in the hemisphere is given by

$$V = \frac{\pi}{3} h^2 (60 - h)$$

When $h = 12$, the height of the liquid is decreasing at a rate of $\frac{1}{60} \text{ cm/s}$

Find the value of k

Give your answer in terms of π

(6)

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Question 7 continued

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Question 7 continued

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(Total for Question 7 is 6 marks)

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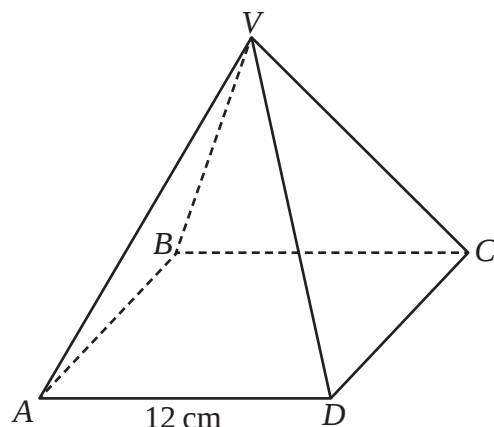


Diagram **NOT**
accurately drawn

Figure 3

Figure 3 shows a right pyramid with vertex V and square base, $ABCD$, of side 12 cm

The size of the angle between the plane VAB and the base $ABCD$ is 30°

- (a) Show that the height of the pyramid is $2\sqrt{3}$ cm (2)
- (b) Find, in cm, the exact length of VA (3)
- (c) Find, in cm^2 , the exact area of triangle VAD (3)
- (d) Find, in cm, the exact length of the perpendicular from D to VA (2)
- (e) Find, in degrees to one decimal place, the size of the obtuse angle between the plane VAB and the plane VAD (3)

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Question 8 continued

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Question 8 continued

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(Total for Question 8 is 13 marks)



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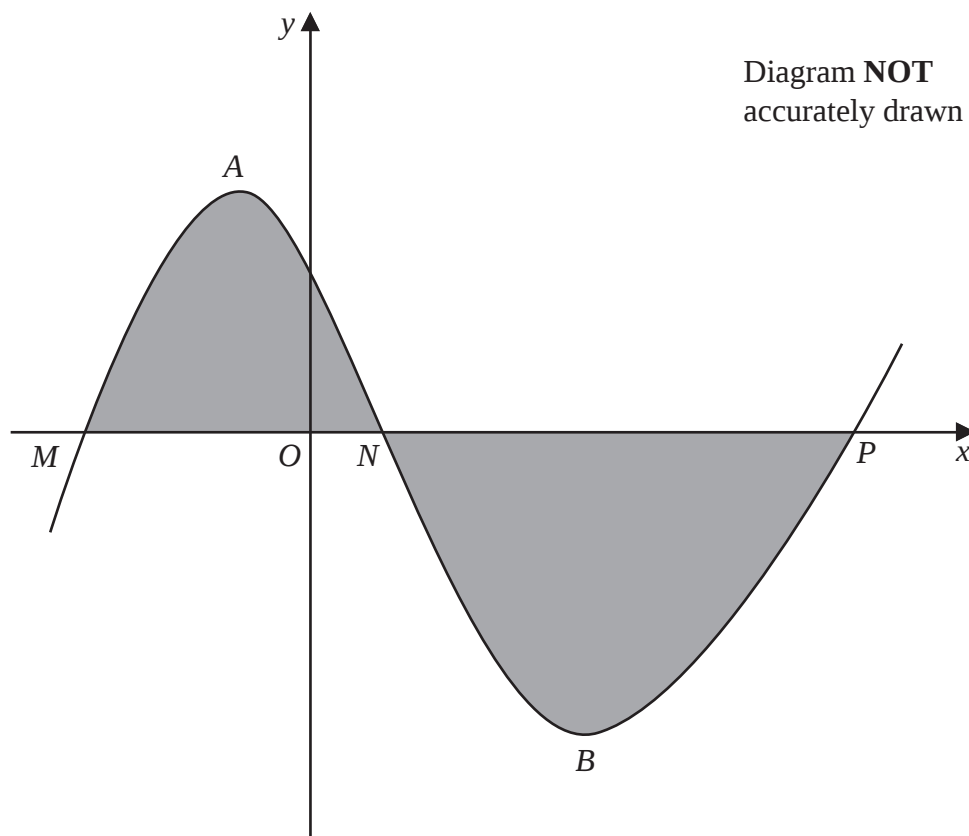


Figure 4

Figure 4 shows a sketch of part of the curve C with equation $y = f(x)$ where

$$f(x) = 2x^3 + ax^2 + bx + c$$

The curve C has a maximum at the point A with coordinates $\left(-\frac{1}{3}, \frac{100}{27}\right)$ and a minimum at the point B with coordinates $(2, -9)$

Given that a , b and c are integers

(a) show that $a = -5$, $b = -4$ and $c = 3$

(5)

(b) (i) Show that $(x+1)$ is a factor of $f(x)$

(1)

(ii) Hence, or otherwise, use algebra to factorise $f(x)$ completely.

(3)

The curve C crosses the x -axis at the points M , N and P

The finite regions shown shaded in Figure 4 are bounded by the curve C and parts of the x -axis from M to N and from N to P

(c) Use algebraic integration to determine the total area of the shaded regions.
Give your answer as an exact fraction.

(4)



Question 9 continued

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Question 9 continued

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Question 9 continued

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(Total for Question 9 is 13 marks)

P 7 2 8 6 5 A 0 3 1 3 6

10 Solve the equation

$$(i) \log_4(6y-5) = 3 \quad (2)$$

$$(ii) \log_4(4-3x)^2 - \log_2(x^2-5) - 3 = 0$$

Show clear algebraic working.
Give your answer to 3 significant figures. (9)

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Question 10 continued

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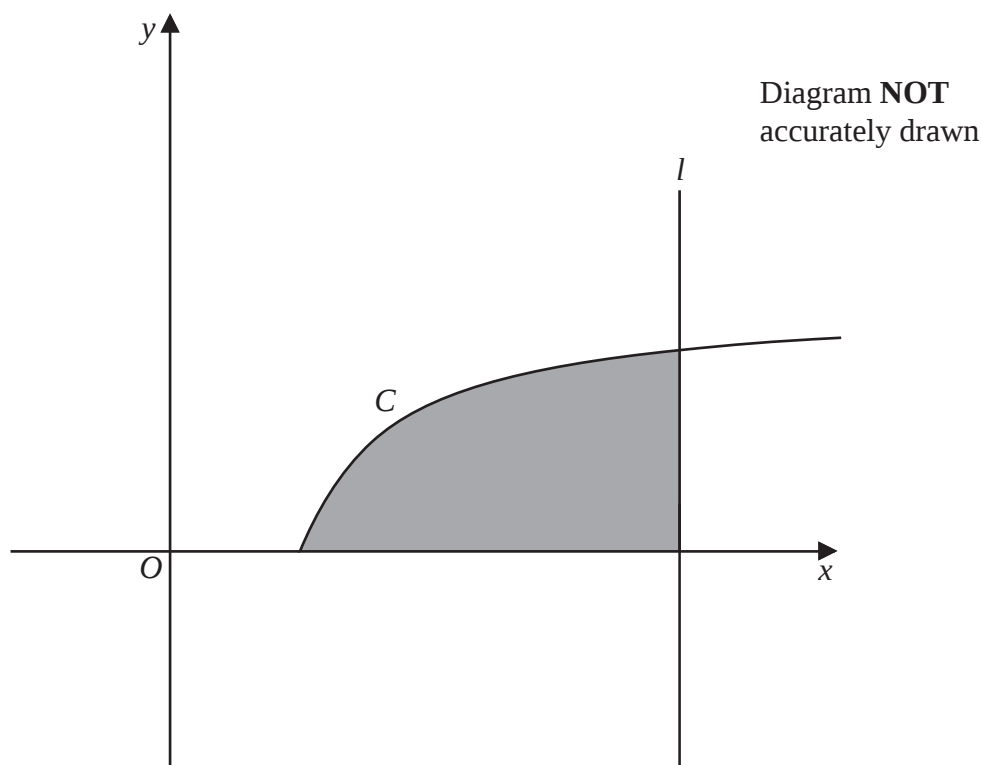
**Figure 5**

Figure 5 shows part of the curve C with equation $y = \sqrt{4x - 8}$ and the line l with equation $x = b$ where $b > 0$

The finite region bounded by the curve C , the x -axis and the line l , shown shaded in Figure 5, is rotated through 360° about the x -axis.

Given that the volume of the solid formed is 50π units³

find the value of b

(7)

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Question 11 continued

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(Total for Question 11 is 7 marks)**TOTAL FOR PAPER IS 100 MARKS**