Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

Pearson Edexcel International GCSE

Friday 14 November 2025

Morning (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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P 7 8 9 6 5 A 0 1 3 2

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

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

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

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

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

Logarithms

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

Answer all ELEVEN questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 A circle has centre O and radius 14 cm

A sector AOB of the circle has a perimeter of 49 cm

Find, in cm^2, the area of sector AOB

(3)

(Total for Question 1 is 3 marks)

2 (a) Use algebra to find the x coordinates of the points where the curve with equation $y = 3x^2 + 9x - 17$ intersects the line with equation $y = 3 - 2x$

(3)

(b) Hence, or otherwise, find the set of values of x for which $3 - 2x \leqslant 3x^2 + 9x - 17$

(2)

Question 2 continued

(Total for Question 2 is 5 marks)

3 Curve S has equation $y = 2 - \frac{5}{2x+1}$ where $x \neq -\frac{1}{2}$

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

(i) the y-axis (ii) the x-axis

(3)

(b) Find the coordinates of the point where S crosses

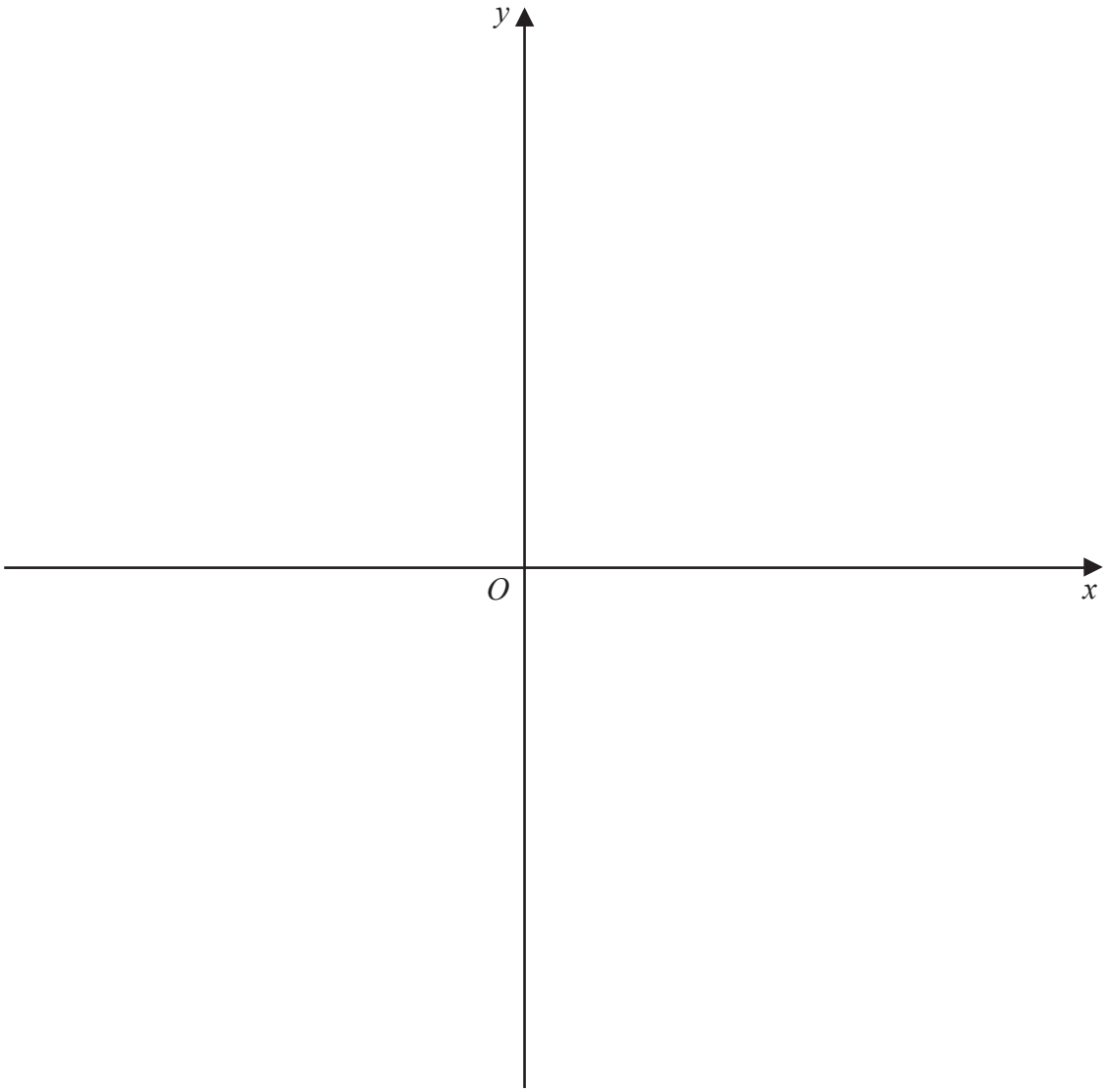
(i) the y-axis (ii) the x-axis

(2)

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

(3)

Question 3 continued



(Total for Question 3 is 8 marks)

4 A particle P is moving along a straight line. At time t seconds $(t \geqslant 0)$, its velocity, v m/s, is given by $v = 4t^2 - 6t + 5$

(a) Find the minimum speed of P

(3)

The acceleration of P at time T seconds is $18\ \text{m/s}^2$

(b) Find the value of T

(2)

When $t = 0$, P is at the point X, and when $t = 3$, P is at the point Y

(c) Find the distance XY

(4)

Question 4 continued

(Total for Question 4 is 9 marks)

5

Diagram **NOT** accurately drawn

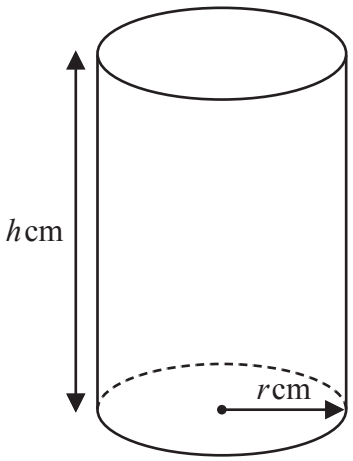


Figure 1

A solid right circular cylinder has base radius r cm and height h cm, as shown in Figure 1

The cylinder has a total surface area of 322π cm^2 and a volume of V cm^3

(a) Show that $V = \pi r\left(161 - r^2\right)$

(3)

Given that r can vary,

(b) use calculus to find, to 3 significant figures, the value of r for which V is a maximum, justifying that this value of r gives a maximum value of V

(5)

(c) Find, to 3 significant figures, the maximum value of V

(2)

Question 5 continued

(Total for Question 5 is 10 marks)

6 (i) A geometric series G has first term $\left(3+\sqrt{3}\right)$ and common ratio r

The second term of G is $\sqrt{3}$

(a) Find, showing all your working, the exact value of r

Give your answer in the form $\frac{p+\sqrt{3}}{q}$ where p and q are integers to be found.

(2)

(b) Explain why G is convergent.

(1)

(ii) A different geometric series H has first term 8 and common ratio 0.6

The sum to n terms of H is S_n and the sum to infinity of H is T

Find, using logarithms, the least value of n such that $T - S_n < 0.12$

(5)

Question 6 continued

(Total for Question 6 is 8 marks)

7 $f(x) = 2x^3 + Ax^2 + Bx - 20$ where A and B are constants.

Given that

- $(2x+1)$ is a factor of $f(x)$
- when $f'(x)$ is divided by $(x-1)$ the remainder is -27

(a) show that $A = 3$ and find the value of B

(5)

(b) Hence, using algebra, solve the equation $f(x) = 0$

(3)

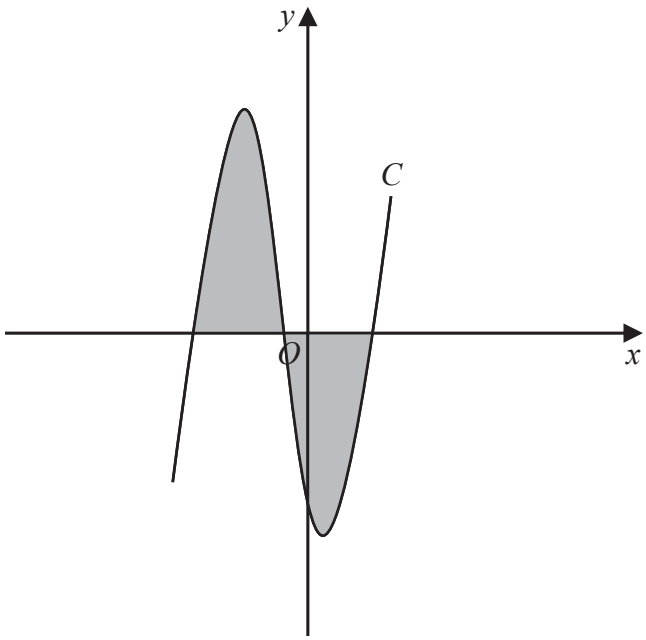


Figure 2

Figure 2 shows a sketch of part of the curve C with equation $y = f(x)$

(c) Use calculus to find the exact area of the finite region bounded by C and the x-axis, shown shaded in Figure 2

(4)

Question 7 continued

Question 7 continued

Question 7 continued

(Total for Question 7 is 12 marks)

8 Solve, using an algebraic method, the simultaneous equations

$$\log_{27} x^3 - \log_3 y = 2$$
$$\log_6 (x + 3y) = 3$$

(8)

Question 8 continued

(Total for Question 8 is 8 marks)

9 The points A, B, C and D are the vertices of a quadrilateral where

$$\overrightarrow{AB} = 2\mathbf{a} + 4\mathbf{b} \qquad \overrightarrow{AC} = 7\mathbf{a} + 7\mathbf{b} \qquad \overrightarrow{AD} = 10\mathbf{a} + 6\mathbf{b}$$

(a) Show that $ABCD$ is a trapezium.

(4)

Given that $|\mathbf{a}| = 1$ and $|\mathbf{b}| = 1$ and that $\mathbf{a}$ and $\mathbf{b}$ are perpendicular to each other

(b) find a unit vector parallel to $\overrightarrow{BD}$

(4)

The point Y lies on CD such that $CY : YD = 1 : 2$

The lines AC and BY intersect at the point X

(c) (i) Use a vector method to find the ratio $BX : XY$

(4)

(ii) Hence find, in its simplest form, the ratio

area of triangle CXY : area of trapezium $ABCD$

(4)

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Question 9 continued

Question 9 continued

Question 9 continued

(Total for Question 9 is 16 marks)

10

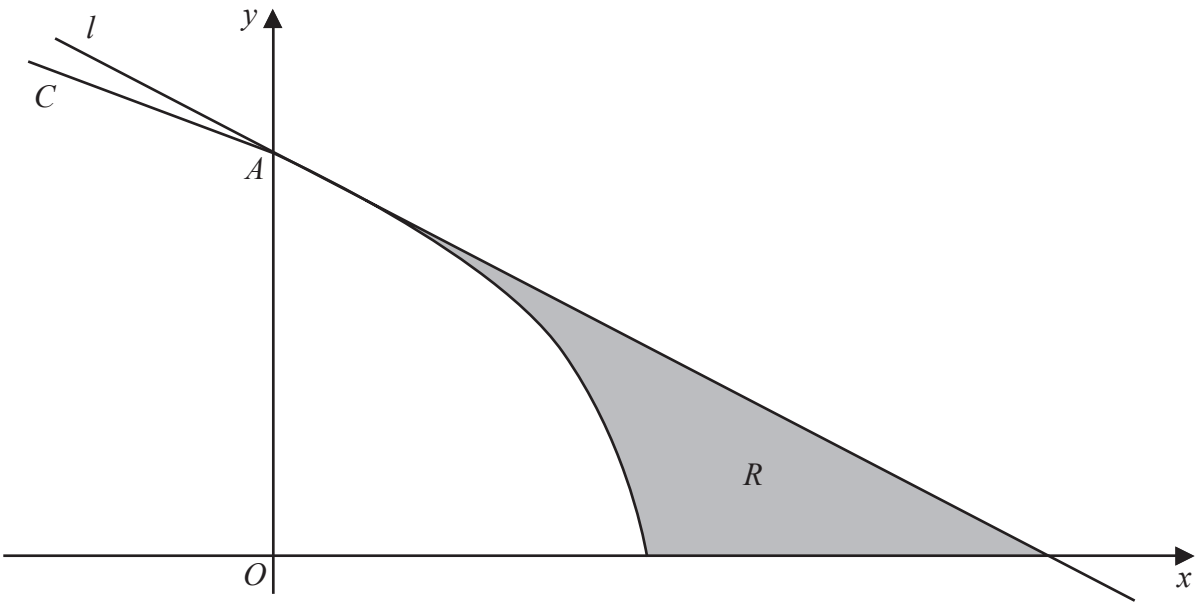

Figure 3

Figure 3 shows part of the curve C with equation $y = 3\sqrt{4-x}$ and part of the line l with equation $px + qy + r = 0$ where p and r are integers and q is prime.

The curve C cuts the y-axis at the point A

The line l is the tangent to C at A

(a) Find the value of p, the value of q and the value of r

(5)

The finite region R, shown shaded in Figure 3, is rotated through 360° about the x-axis.

(b) Use algebraic integration to find the volume of the solid formed.
Give your answer in terms of π

(5)

Question 10 continued

Question 10 continued

Question 10 continued

(Total for Question 10 is 10 marks)

11

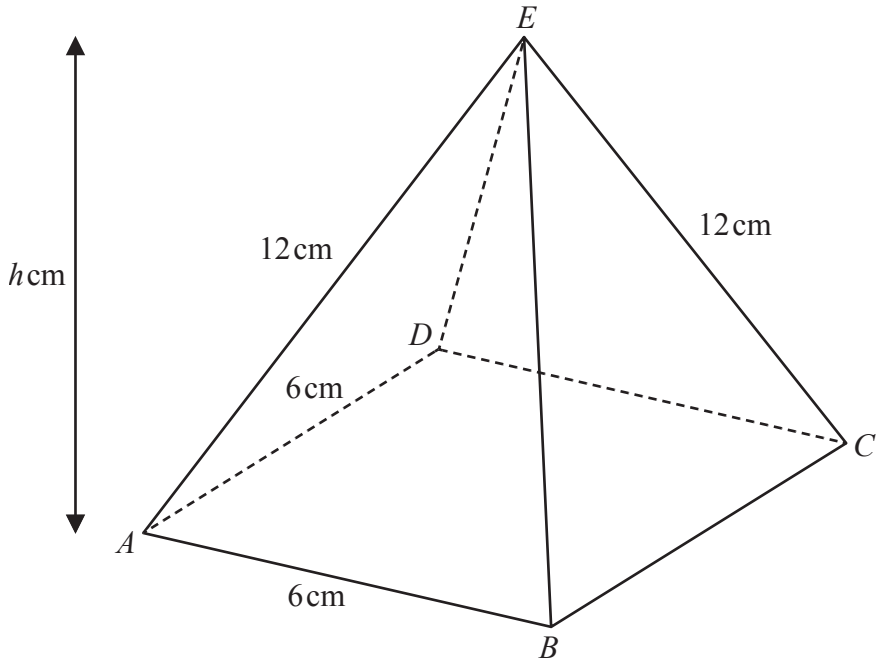

Diagram **NOT** accurately drawn

Figure 4

Figure 4 shows a right pyramid $ABCDE$ with

- vertex E
- horizontal square base $ABCD$ of side 6 cm
- $EA = EB = EC = ED = 12$ cm
- vertical height of h cm

(a) Show that $h = 3\sqrt{14}$

(3)

(b) Find, in degrees to one decimal place, the size of the angle between EB and the plane $ABCD$

(2)

The midpoint of AE is P and the midpoint of BE is Q

(c) Find, to the nearest degree, the size of the obtuse angle between the plane EPQ and the plane $PQCD$

(6)

Question 11 continued

Question 11 continued

Question 11 continued

Question 11 continued

(Total for Question 11 is 11 marks)

TOTAL FOR PAPER IS 100 MARKS