

Please check the examination details below before entering your candidate information

Candidate surname					Other names				
Centre Number					Candidate Number				

Pearson Edexcel International GCSE

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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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

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

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

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

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

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

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

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

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

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

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** The n th term of an arithmetic series is a_n where

$$a_{10} + a_{11} + a_{12} = 129 \quad \text{and} \quad a_{19} + a_{20} + a_{21} = 237$$

Find a_1

(4)

(Total for Question 1 is 4 marks)



- 2 The point A has coordinates $(-5, 3)$, the point B has coordinates $(4, 0)$ and the point C has coordinates $(-1, 5)$.

The line l passes through C and is perpendicular to AB .

- (a) Find an equation of l .

Give your answer in the form $ax + by + c = 0$ where a , b and c are integers.

(4)

The line l intersects AB at the point D .

- (b) Show that the coordinates of D are $(-2, 2)$.

(3)

- (c) Show that l is not the perpendicular bisector of AB .

(2)

- (d) Find the value of $\tan \angle ABC$.

Give your answer in its simplest form.

(4)

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Question 2 continued

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Question 2 continued

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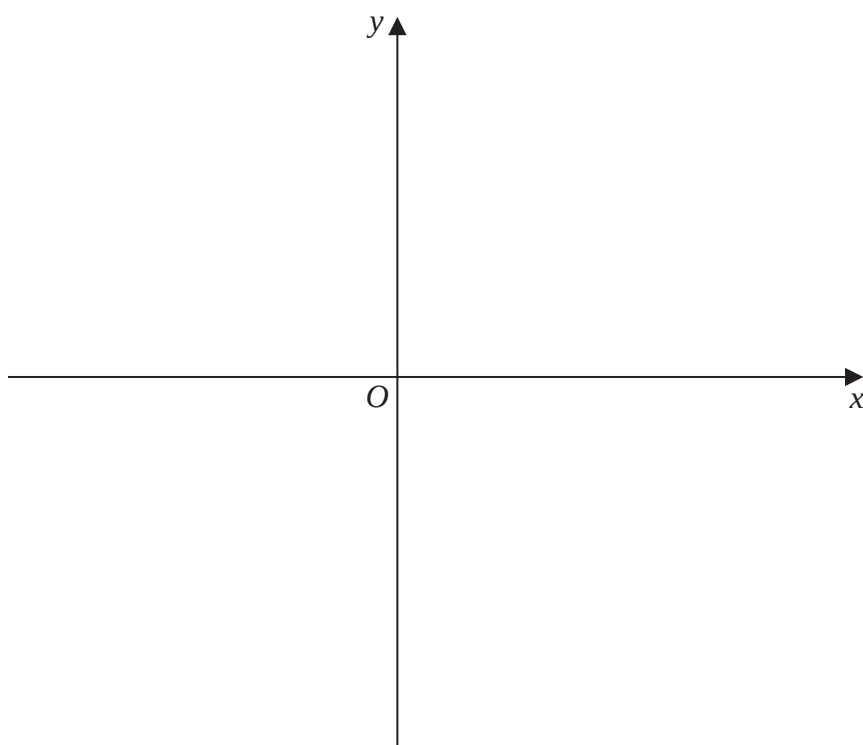
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(Total for Question 2 is 13 marks)

- 3 Curve C has equation $y = \frac{ax + 3}{1 - 2x}$ where $x \neq \frac{1}{2}$ and a is a constant.

The asymptote to C that is parallel to the x -axis has equation $y = 4$

- (a) Find the value of a (2)
- (b) Write down the equation of the asymptote to C that is parallel to the y -axis. (1)
- (c) Find the coordinates of the point where C crosses
 (i) the x -axis, (ii) the y -axis. (2)
- (d) Using the axes below, sketch C , showing clearly the asymptotes and the coordinates of the points where C crosses the coordinate axes. (4)



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Question 3 continued

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(Total for Question 3 is 9 marks)

4

$$f(x) = x^3 + px^2 + qx + 6 \quad \text{where } p \text{ and } q \text{ are constants.}$$

Given that $(x - 1)$ is a factor of $f(x)$ and that when $f(x)$ is divided by $(x + 1)$ the remainder is 8

(a) (i) show that $p = -2$

(ii) find the value of q

(6)

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

(3)

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Question 4 continued

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(Total for Question 4 is 9 marks)

5 Given that k is a non-zero constant

curve C has equation $kx^2 - xy + (k + 1)x = 1$

straight line l has equation $y = \frac{k}{2}x + 1$

The point A is the only point that lies on both C and l .

(a) Find the value of k

(6)

(b) Hence, find the coordinates of A .

(2)

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Question 5 continued

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(Total for Question 5 is 8 marks)

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- 6 Given that $(8 + 3x)^{\frac{1}{3}}$ can be expressed in the form $p(1 + qx)^{\frac{1}{3}}$ where p and q are constants,

(a) find the value of p and the value of q

(2)

(b) Hence, expand $(8 + 3x)^{\frac{1}{3}}$ in ascending powers of x up to and including the term in x^2 , expressing each coefficient as an exact fraction in its lowest terms.

(3)

Using the expansion found in part (b) with a suitable value of x

(c) show that $\sqrt[3]{9} \approx \frac{599}{288}$

(2)

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Question 6 continued

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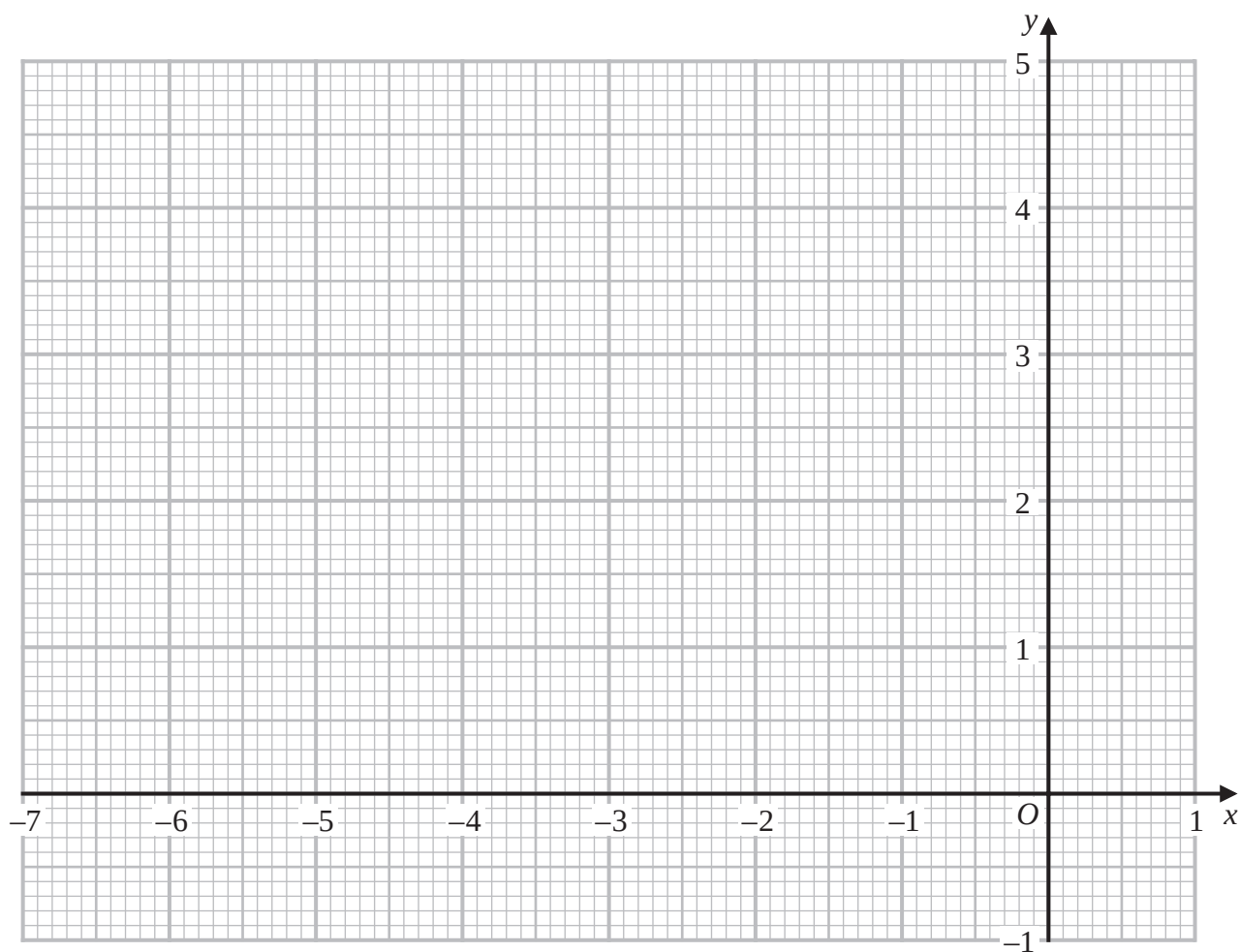
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(Total for Question 6 is 7 marks)

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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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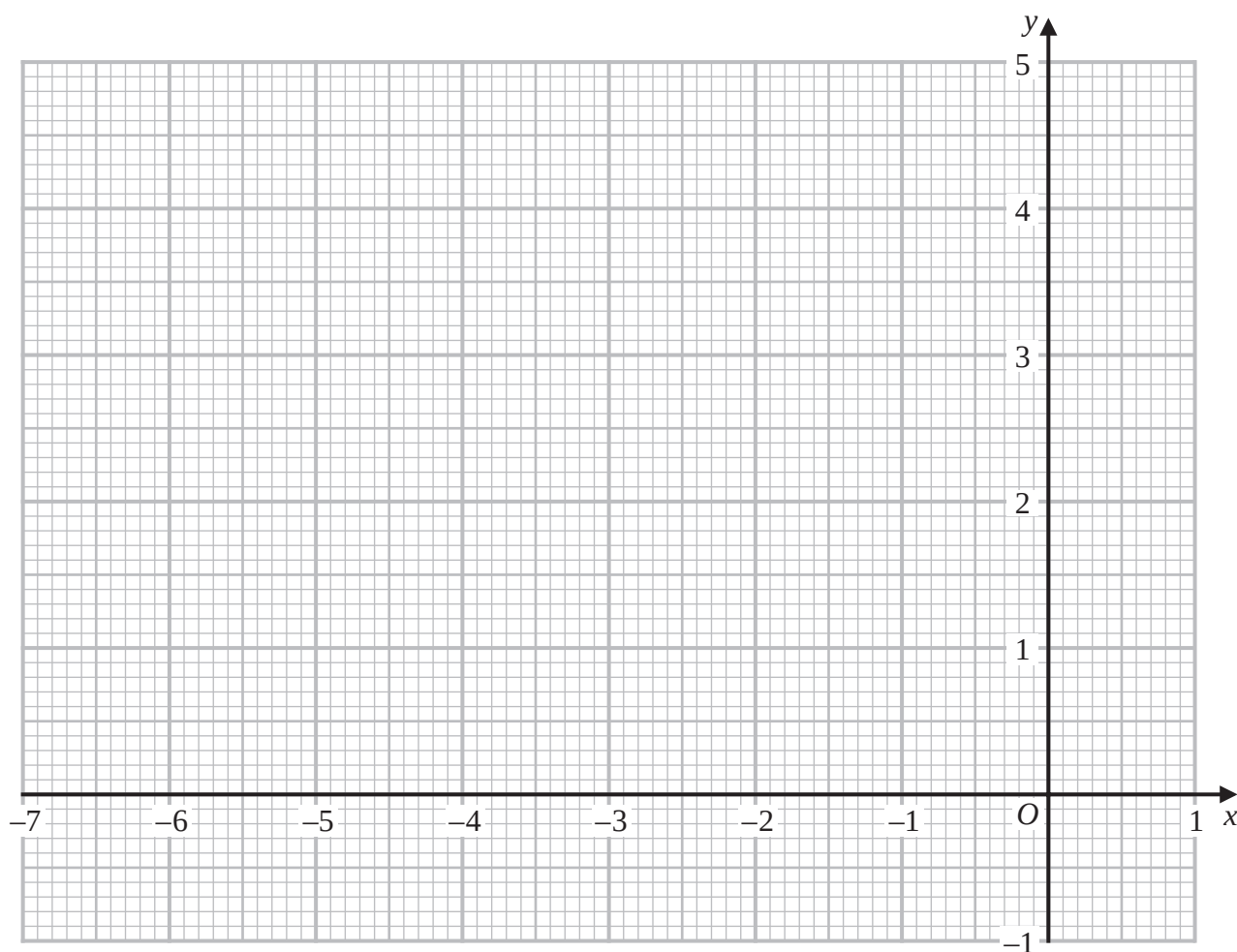
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Question 7 continued

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(Total for Question 7 is 10 marks)



8

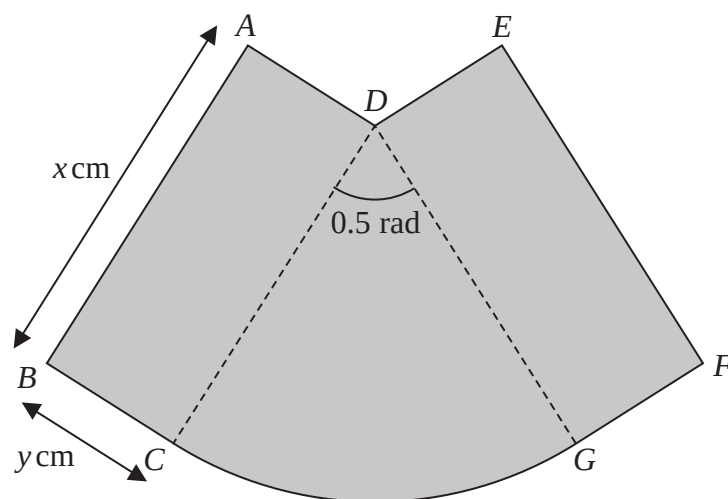


Figure 1

Figure 1 shows a badge, shown shaded, made from two identical rectangles, $ABCD$ and $DEFG$, and a sector DCG of a circle with centre D .

Each rectangle measures x cm by y cm.

The radius of the sector is x cm and the angle CDG is 0.5 radians.

The area of the badge is 50 cm^2

The perimeter of the badge is P cm.

(a) Show that

$$P = 2x + \frac{100}{x} \quad (5)$$

Given that x can vary,

(b) use calculus, to find the exact value of x for which P is a minimum.

Justify that this value of x gives a minimum value for P

(6)

(c) Find the minimum value of P

Give your answer in the form $k\sqrt{2}$, where k is an integer to be found.

(2)

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Question 8 continued

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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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9 Giving each value in your solution to 2 decimal places, solve the simultaneous equations

$$e^{2y} - x + 2 = 0$$

$$\ln(x + 3) - 2y - 1 = 0$$

(8)

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Question 9 continued

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(Total for Question 9 is 8 marks)

Question 10 continued

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Question 10 continued

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Question 10 continued

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(Total for Question 10 is 9 marks)

Question 11 continued

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Question 11 continued

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(Total for Question 11 is 10 marks)**TOTAL FOR PAPER IS 100 MARKS**