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Surname	Other names
Pearson Edexcel	Centre Number
International GCSE	Candidate Number
<h1 style="margin: 0;">Further Pure Mathematics</h1> <h2 style="margin: 0;">Paper 1</h2>	
Friday 13 January 2017 – Morning Time: 2 hours	Paper Reference 4PM0/01
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.*

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.

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Question 1 continued

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(Total for Question 1 is 5 marks)



- 2 $f(x) = 2x^3 - 3px^2 + x + 4p$ where p is an integer.
- Given that $(x - 4)$ is a factor of $f(x)$
- (a) show that the value of p is 3 (2)
- Using this value of p ,
- (b) find the remainder when $f(x)$ is divided by $(x + 2)$ (2)
- (c) factorise $f(x)$ completely (3)
- (d) solve the equation $2x^3 - 3px^2 + x + 4p = 0$ (2)

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Question 2 continued

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3 Use algebra to find the set of values of x for which $(3x - 1)(x - 1) < 2(3x - 1)$

(5)

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(Total for Question 3 is 5 marks)



4 The n th term of a geometric series is t_n and the common ratio is r .

Given that $t_2 + t_5 = \frac{28}{81}$ and $t_2 - t_5 = \frac{76}{405}$

(a) (i) show that $r = \frac{2}{3}$

(ii) find the first term of the series.

(6)

(b) Find the sum to infinity of this geometric series.

(2)

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Question 4 continued

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(Total for Question 4 is 8 marks)



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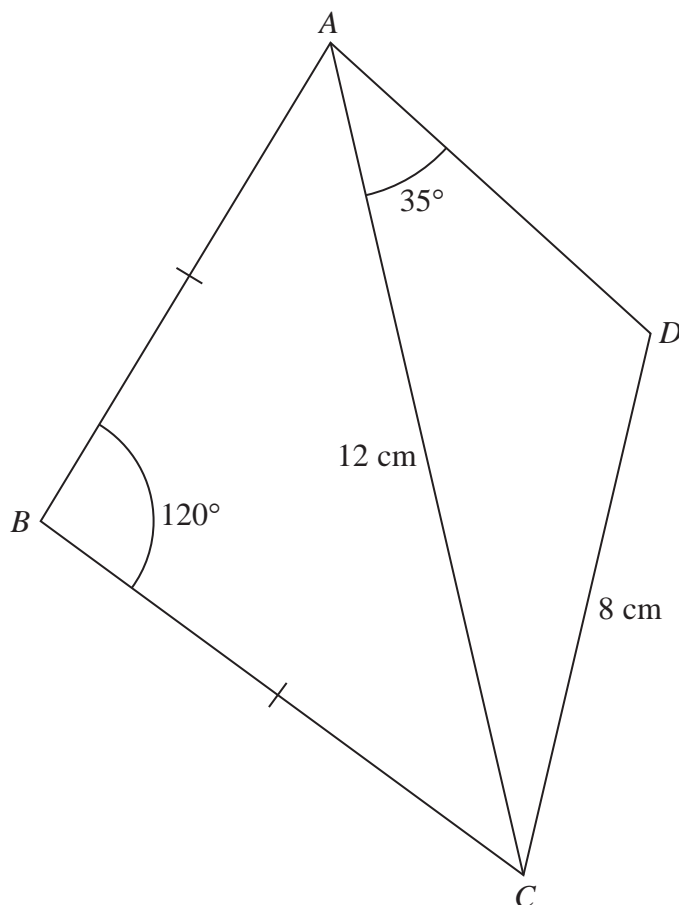


Diagram NOT accurately drawn

Figure 2

Figure 2 shows the quadrilateral $ABCD$ in which $AB = BC$.

$DC = 8 \text{ cm}$ $AC = 12 \text{ cm}$ $\angle ABC = 120^\circ$ $\angle CAD = 35^\circ$

Find

(a) the exact length, in cm, of AB . (2)

Given that angle ADC is obtuse, find

(b) the size, in degrees to 1 decimal place, of angle ADC , (3)

(c) the area, in cm^2 to 3 significant figures, of the quadrilateral $ABCD$. (6)

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Question 5 continued

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Question 5 continued

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Question 5 continued

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(Total for Question 5 is 11 marks)



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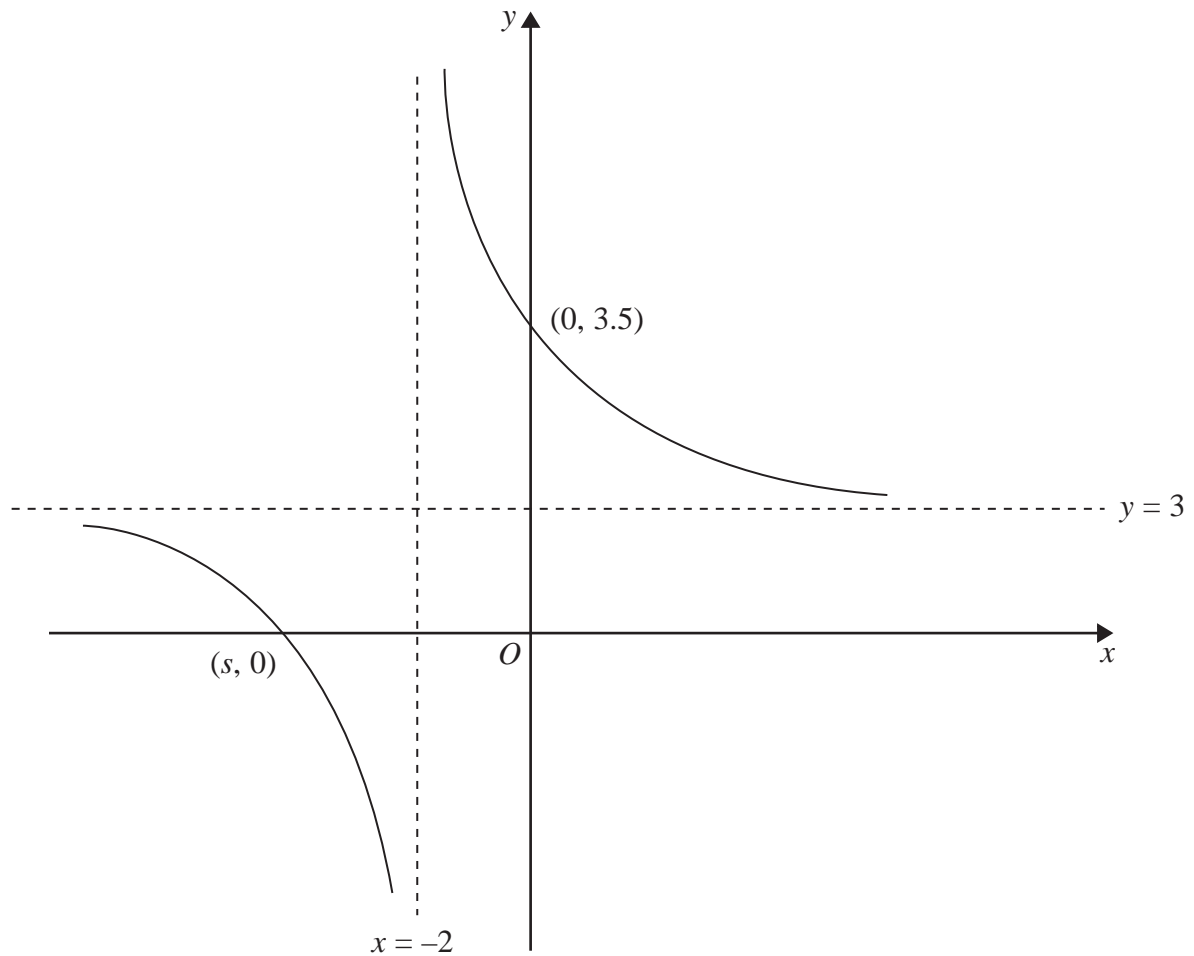


Figure 3

Figure 3 shows a sketch of the curve with equation

$$y = \frac{bx + c}{x + a} \quad x \neq -a,$$

where a , b and c are integers.

The equations of the asymptotes to the curve are $x = -2$ and $y = 3$

The curve crosses the y -axis at $(0, 3.5)$

(a) Write down the value of a and the value of b . (2)

(b) Find the value of c . (2)

Given that the curve crosses the x -axis at $(s, 0)$

(c) find the value of s . (2)

Question 6 continued

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(Total for Question 6 is 6 marks)



- 7 (a) Complete the table of values for $y = \ln(5x + 1) + 2$ giving your answers to 2 decimal places.

x	0	1	2	3	4	5	6	7
y	2		4.40	4.77	5.04		5.43	

(2)

- (b) On the grid opposite draw the graph of $y = \ln(5x + 1) + 2$ for $0 \leq x \leq 7$

(2)

- (c) By drawing an appropriate straight line on the grid, obtain an estimate, to 1 decimal place, of the positive root of the equation $\ln(5x + 1) - x = 0$ in the interval $0 \leq x \leq 7$

(3)

- (d) By drawing an appropriate straight line on the grid, obtain an estimate, to 1 decimal place, of the root of the equation $e^{(3x-1)} = 5x + 1$ in the interval $0 \leq x \leq 7$

(4)

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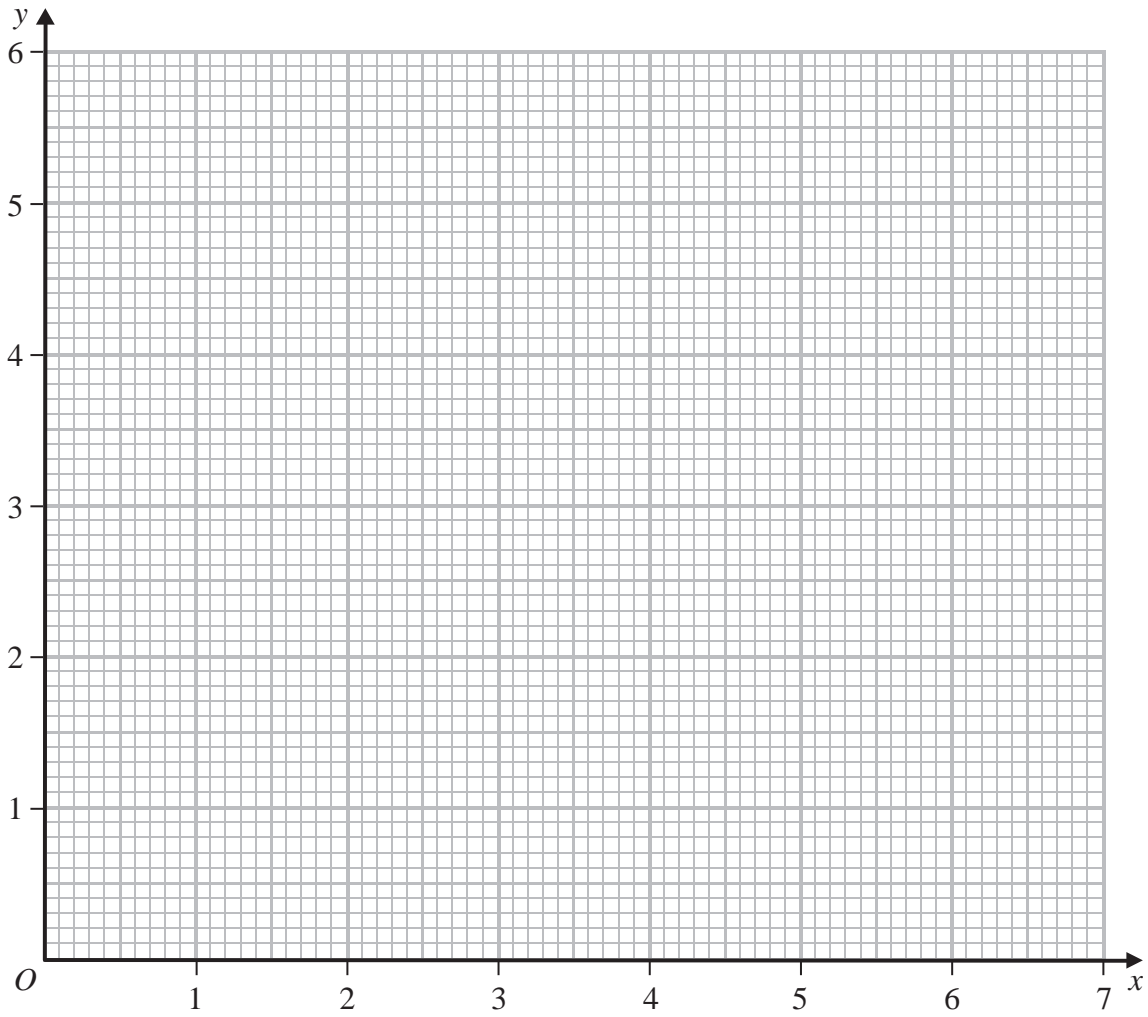


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Question 7 continued



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Question 7 continued

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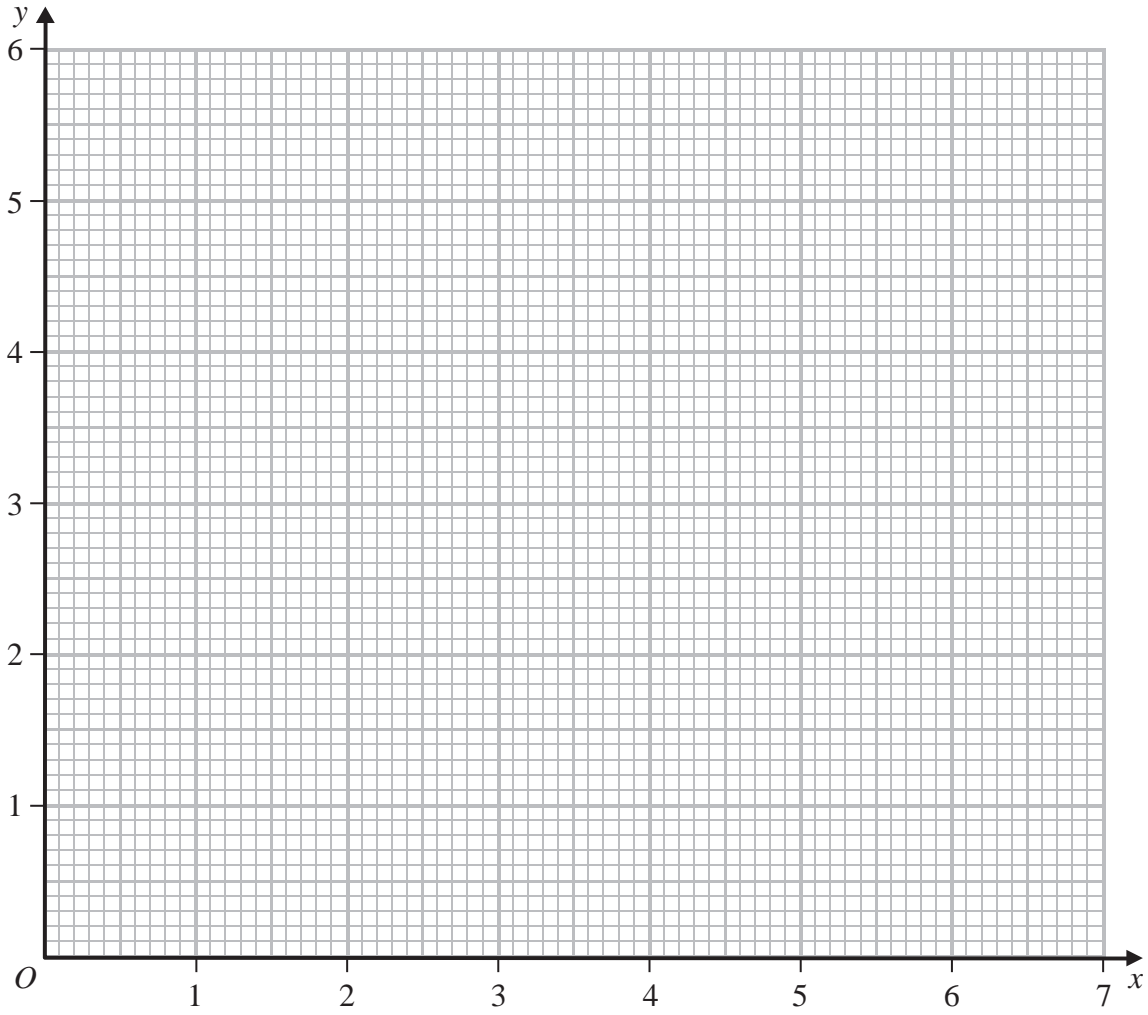
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Question 7 continued

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(Total for Question 7 is 11 marks)



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

(ii) Find the range of values for which your expression is valid. (4)

- (b) Express $(2 + x)^{-3}$ in the form $A(1 + Bx)^{-3}$ where A and B are rational numbers whose values should be stated. (2)

$$f(x) = \frac{(1 + 4x)}{(2 + x)^3}$$

- (c) Obtain a series expansion for $f(x)$ in ascending powers of x up to and including the term in x^2 . (2)

- (d) Hence obtain an estimate, to 3 significant figures, of $\int_0^{0.2} \frac{(1 + 4x)}{(2 + x)^3} dx$ (3)

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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 11 marks)



9 The equation $3x^2 - 4x + 6 = 0$ has roots α and β .

(a) Without solving the equation, write down

(i) the value of $\alpha + \beta$

(ii) the value of $\alpha\beta$

(2)

(b) Without solving the equation, show that $\alpha^3 + \beta^3 = -\frac{152}{27}$

(3)

(c) Form a quadratic equation, with integer coefficients, that has roots $\frac{\alpha}{\beta^2}$ and $\frac{\beta}{\alpha^2}$

(5)

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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 10 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)



11 The curve C has equation $y = px + qx^2$ where p and q are integers.

The curve C has a stationary point at $(3, 9)$.

(a) (i) Show that $p = 6$ and find the value of q .

(ii) Determine the nature of the stationary point at $(3, 9)$.

(7)

The straight line l with equation $y + x - 10 = 0$ intersects C at two points.

(b) Determine the x coordinate of each of these two points of intersection.

(3)

The finite region bounded by the curve C and the straight line l is rotated through 360° about the x -axis.

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

(5)

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Question 11 continued

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Question 11 continued

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