Write your name here

Surname	Other names

Pearson Edexcel
International GCSE

Centre Number	Candidate Number

Further Pure Mathematics

Paper 1

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.

Turn over ▶

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Pearson

Answer all ELEVEN questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1

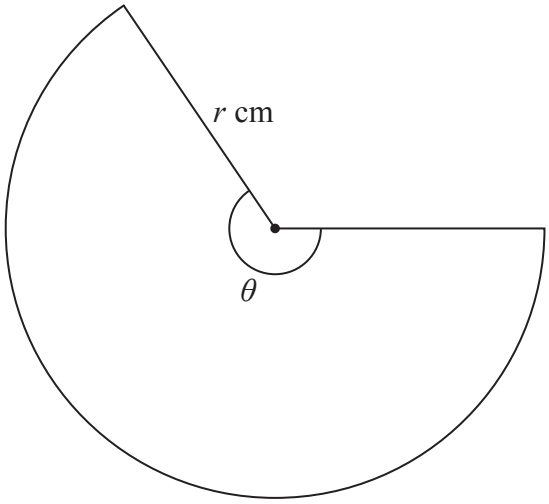

Diagram **NOT** accurately drawn

Figure 1

Figure 1 shows a sector of a circle. The circle has radius r cm and the sector has angle θ radians. The sector has an arc length of 18π cm and an area of 126π cm^2.

Find

(i) the value of r,

(ii) the exact value of θ.

(5)

Question 1 continued

(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)

Question 2 continued

Question 2 continued

(Total for Question 2 is 9 marks)

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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)

(Total for Question 3 is 5 marks)

4 The nth 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)

Question 4 continued

(Total for Question 4 is 8 marks)

5

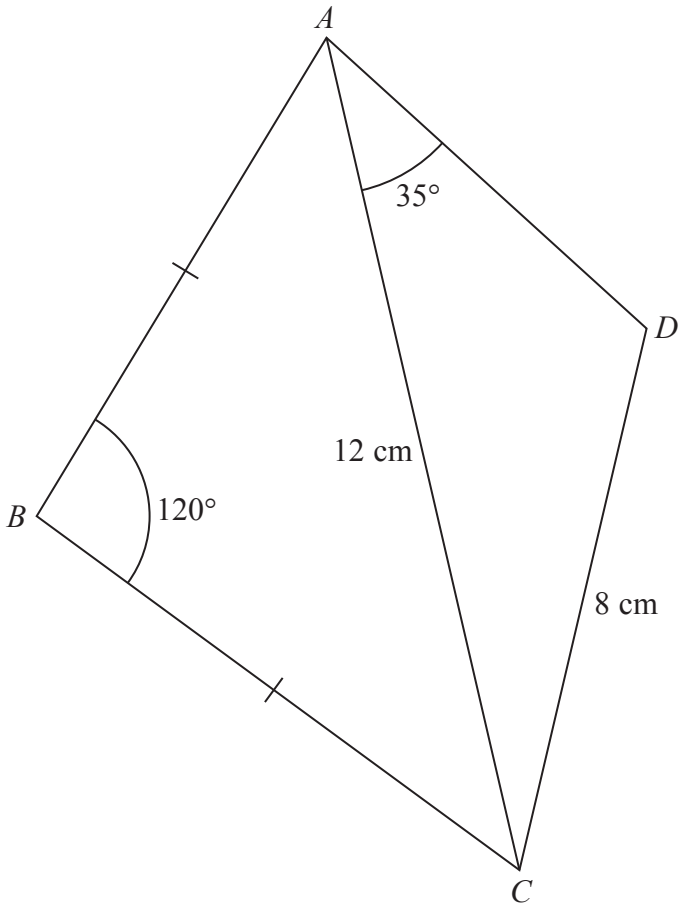


Diagram **NOT** accurately drawn

Figure 2

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

$DC = 8$ cm $\quad AC = 12$ cm $\quad \angle ABC = 120°$ $\quad \angle CAD = 35°$

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)

Question 5 continued

Question 5 continued

Question 5 continued

(Total for Question 5 is 11 marks)

6

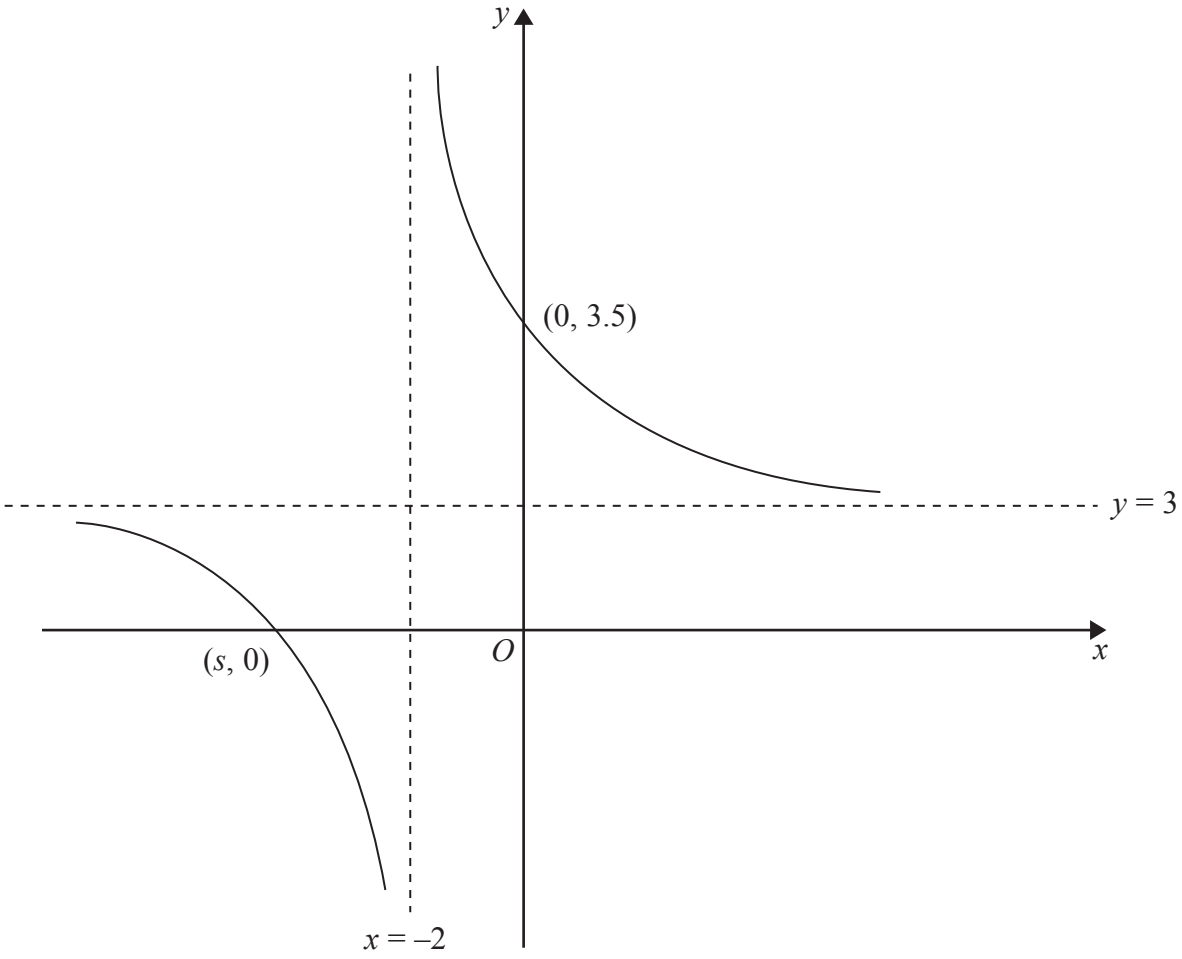


Figure 3

Figure 3 shows a sketch of the curve with equation

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

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

(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 $0 \leqslant x \leqslant 7$

(2)

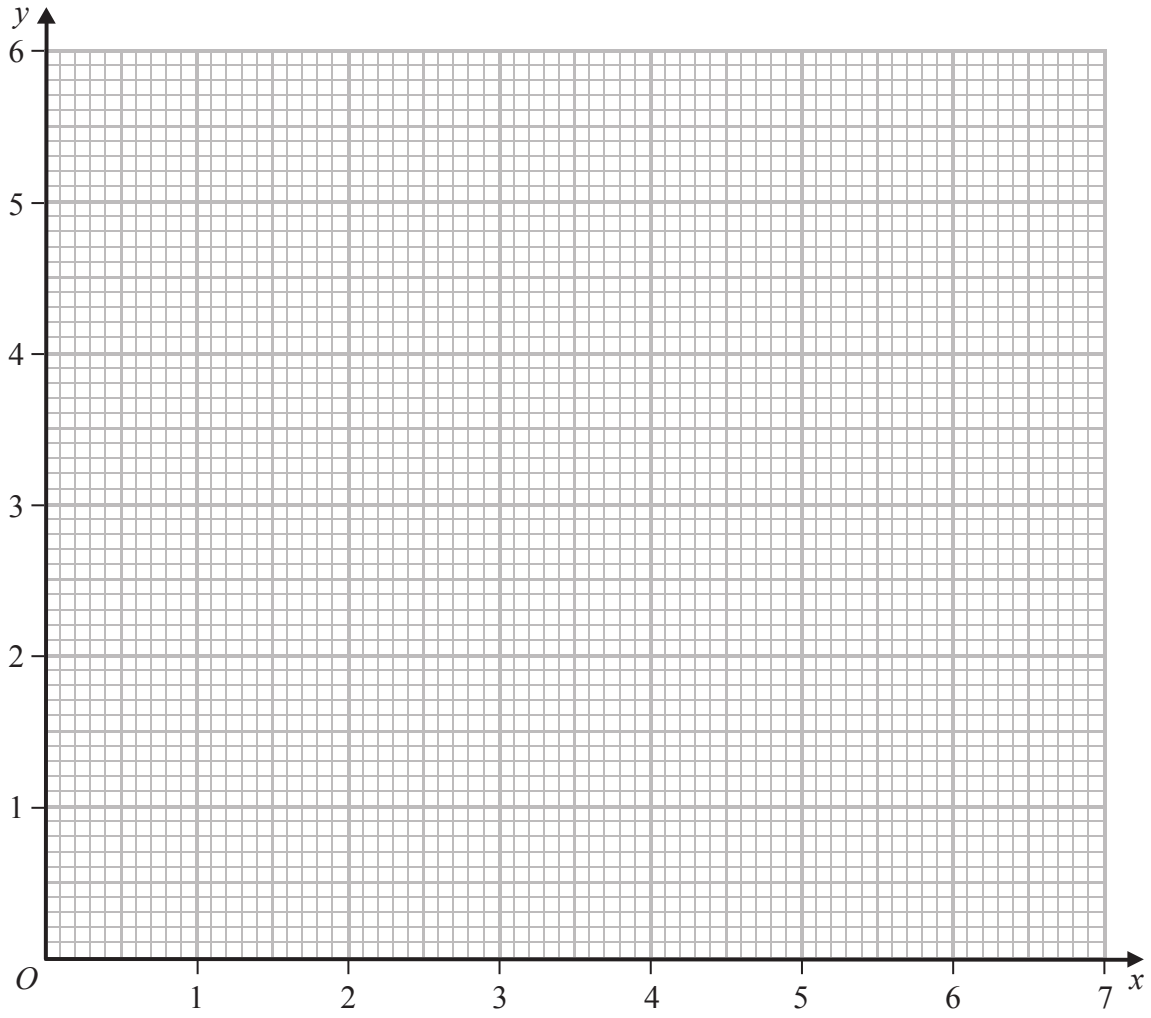
(c) By drawing an appropriate straight line on the grid, obtain an estimate, to 1 decimal place, of the positive root of the equation $\ln(5x + 1) - x = 0$ in the interval $0 \leqslant x \leqslant 7$

(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 $0 \leqslant x \leqslant 7$

(4)

Question 7 continued

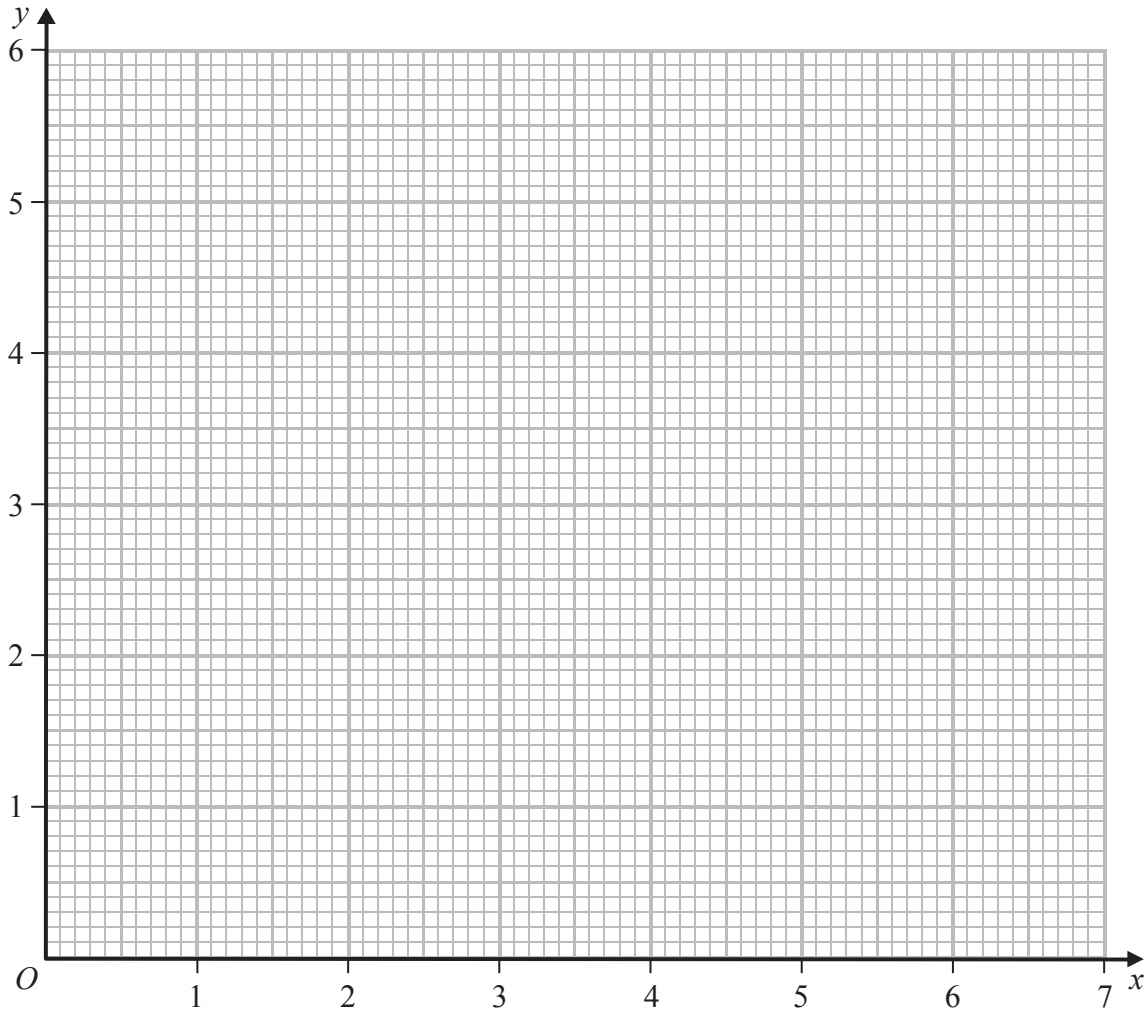


Turn over for a spare grid if you need to redraw your graph

Question 7 continued

Question 7 continued

Only use this grid if you need to redraw your graph



(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)

Question 8 continued

Question 8 continued

Question 8 continued

(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)

Question 9 continued

Question 9 continued

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Question 9 continued

(Total for Question 9 is 10 marks)

10 A particle P moves along the positive x-axis. At time t seconds ($t \geqslant 0$) the velocity, v m/s, of P is given by $v = t^3 - 4t^2 + 5t + 1$

The acceleration of P at time t seconds is a m/s^2

(a) Find an expression for a in terms of t.

(2)

(b) Find the values of t for which the magnitude of the acceleration of P is instantaneously zero.

(2)

When $t = 0$, the displacement of P from the origin is 3 m.

(c) Find the displacement of P from the origin when $t = 2$

(5)

Question 10 continued

Question 10 continued

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Question 10 continued

(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)

Question 11 continued

Question 11 continued

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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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