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

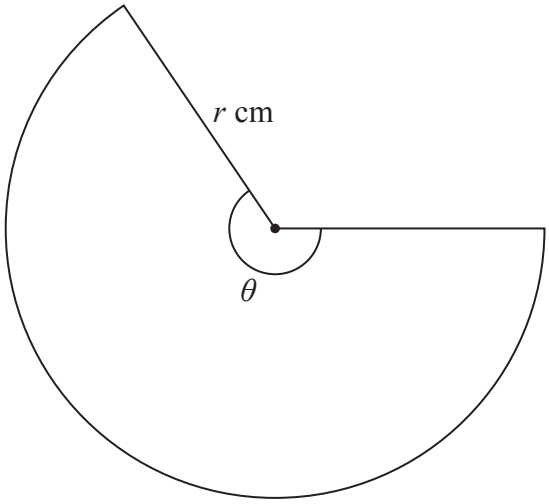

Diagram **NOT** accurately drawn

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)

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

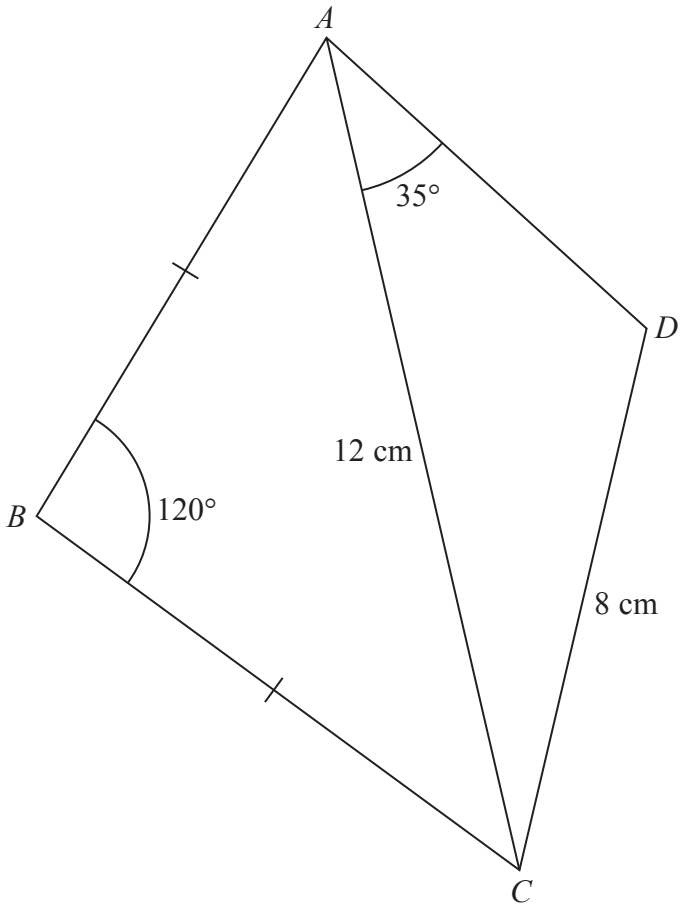

Diagram **NOT** accurately drawn

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)

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Question 5 continued

Question 5 continued

Question 5 continued

(Total for Question 5 is 11 marks)

6

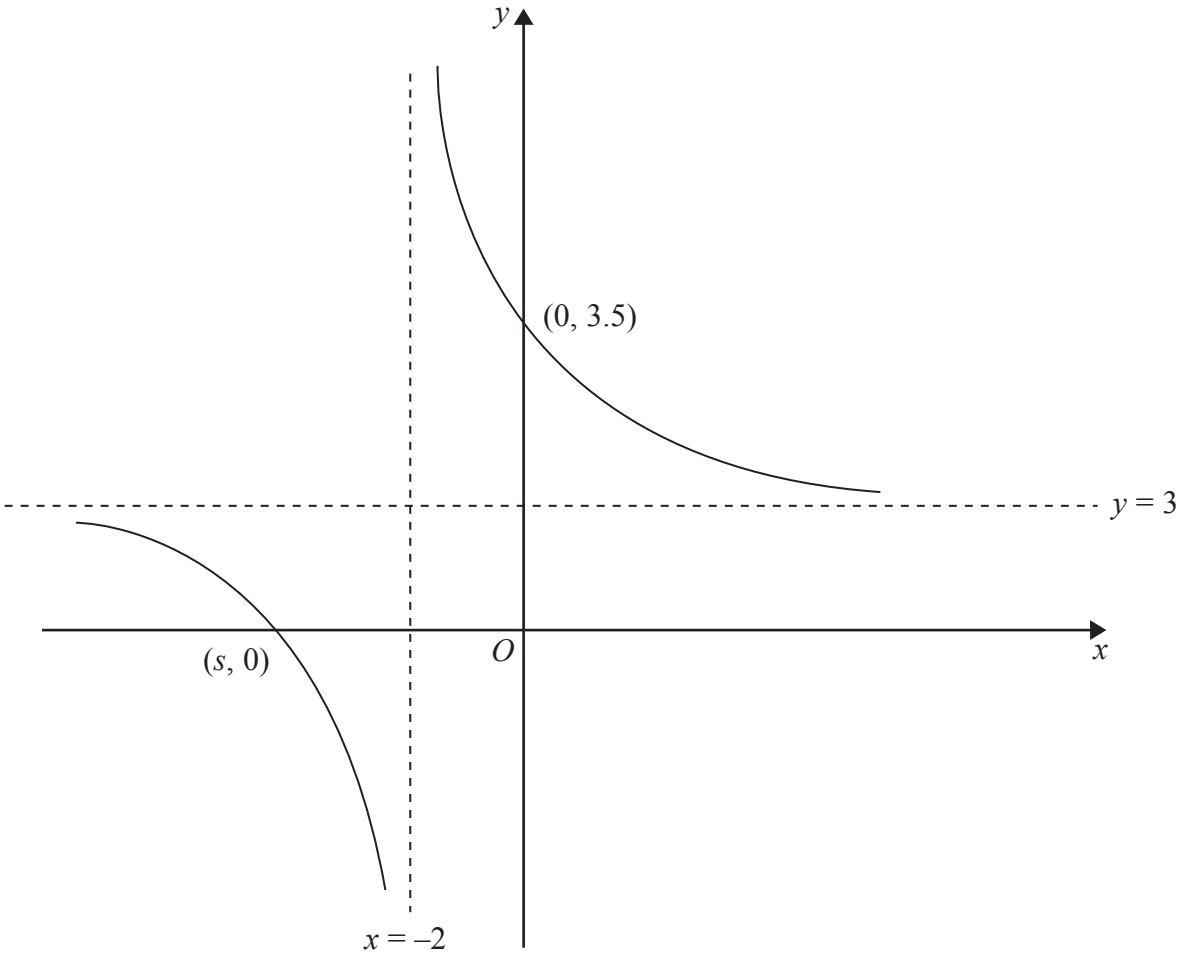


Figure 3

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)

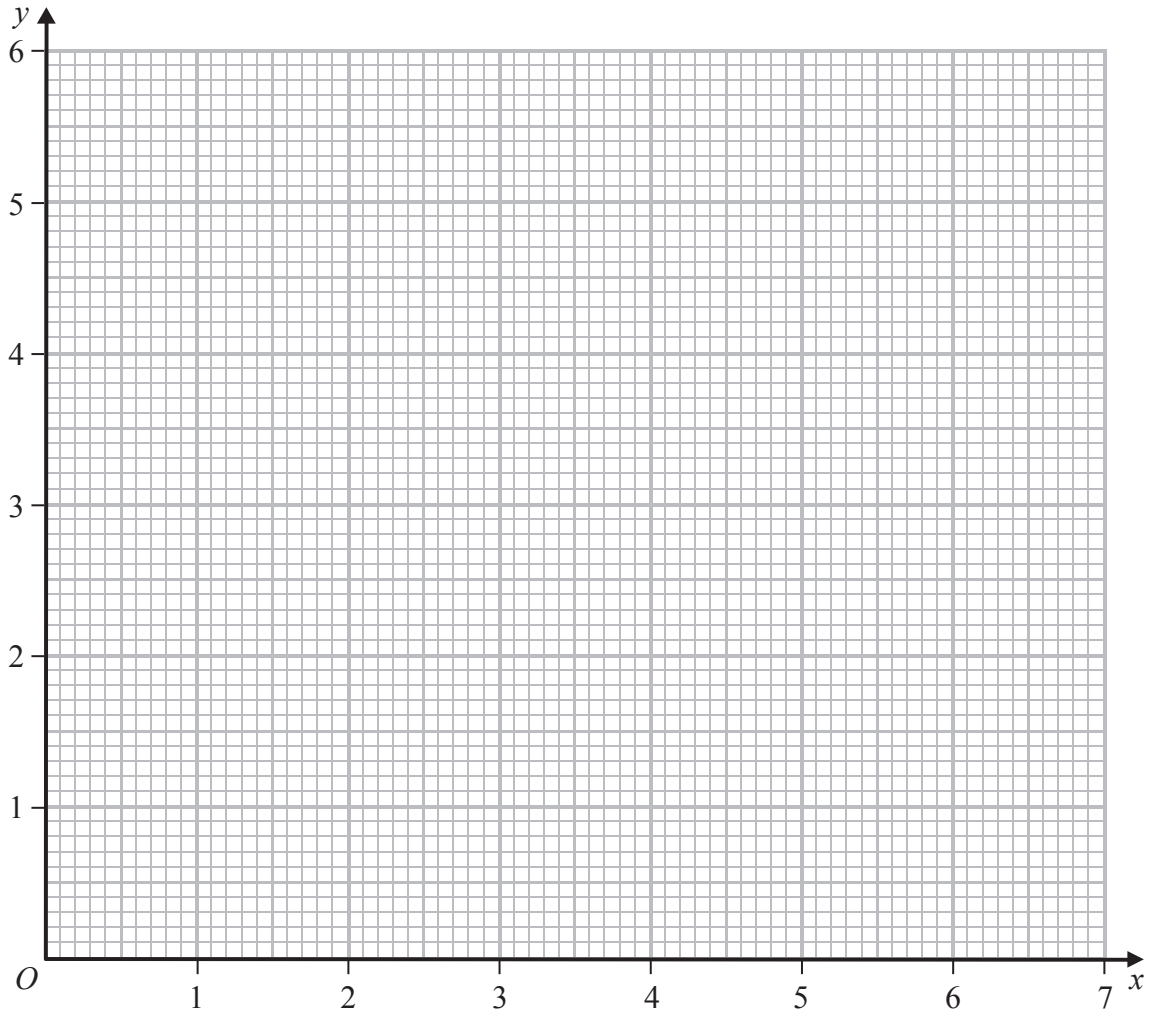
(c) By drawing an appropriate straight line on the grid, obtain an estimate, to 1 decimal place, of the positive root of the equation $\ln(5x + 1) - x = 0$ in the interval $0 \leqslant x \leqslant 7$

(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

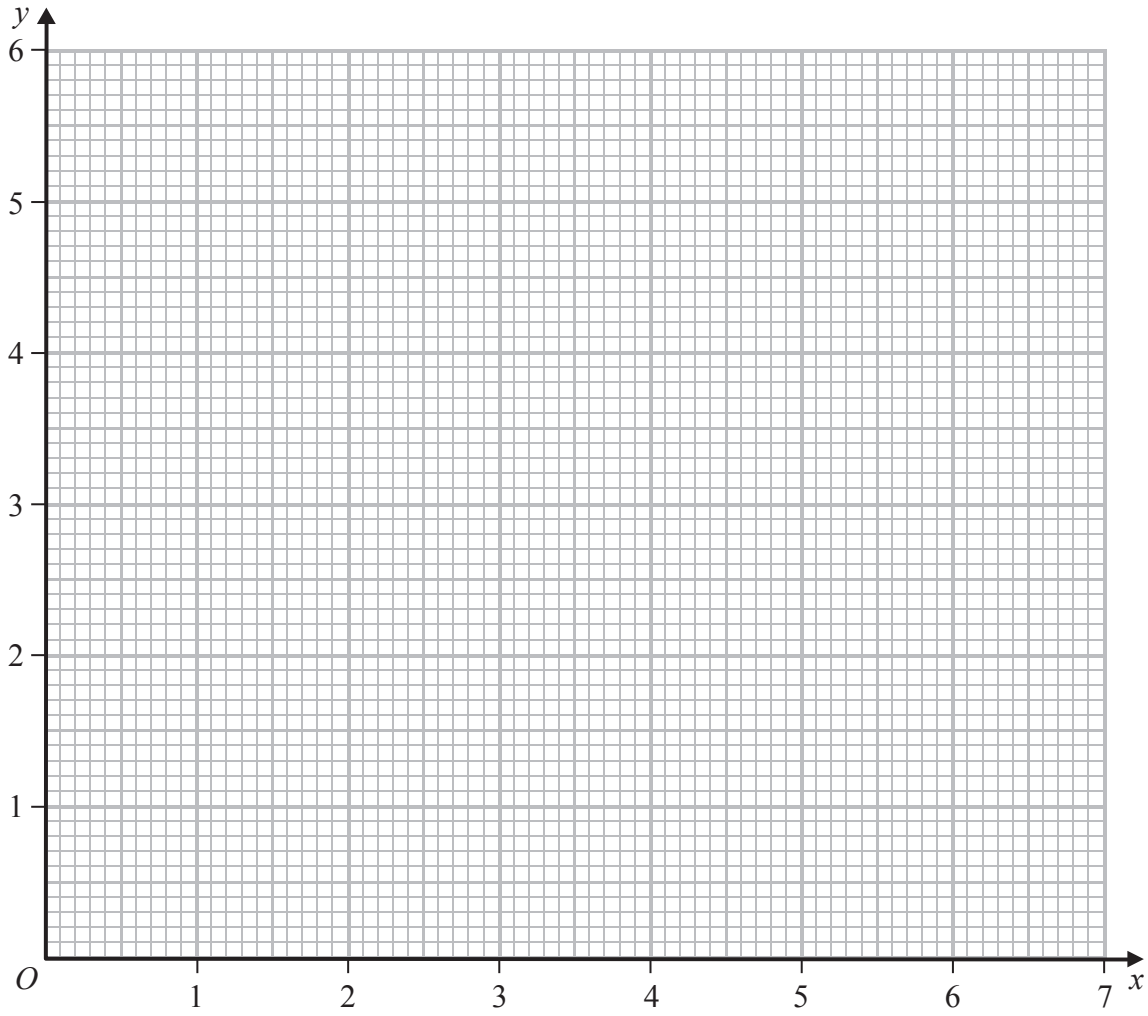


Turn over for a spare grid if you need to redraw your graph

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

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

Question 11 continued

Question 11 continued

(Total for Question 11 is 15 marks)

TOTAL FOR PAPER IS 100 MARKS