Paper Reference 4PM1/01R
Pearson Edexcel
International GCSE

Total Marks

Further Pure Mathematics
Paper 1R

Monday 17 June 2019 − Afternoon

Time: 2 hours plus your additional time allowance.

In the boxes below, write your name, centre number and candidate number.

Surname					
Other names					
Centre Number					
Candidate Number					

Q61882A

Pearson

Calculators may be used.

YOU WILL BE GIVEN

Diagram Book
Answer Book
Formulae Pages

INSTRUCTIONS

Answer ALL questions.

Without sufficient working, correct answers may be awarded no marks.

Answer the questions in the spaces provided in this Question Paper or on the separate diagrams – there may be more space than you need.

Do NOT write on the Question Paper.

You must NOT write on the formulae pages. Anything you write on the formulae pages will gain NO credit.

Diagrams and models are NOT accurate unless otherwise indicated.

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.

There may be spare copies of some diagrams.

ADVICE

Read each question carefully before you start to answer it.

Check your answers if you have time at the end.

Answer all ELEVEN questions.

Write your answers in the Answer Book.

You must write down all the stages in your working.

1. Look at the diagram for Question 1 in the Diagram Book.
It is NOT accurately drawn.

It shows sector AOB of a circle with centre O and radius r cm
The angle AOB is $1 \cdot 5$ radians and the length of arc AB is 12 cm

Calculate

(a) the value of r,
(1 mark)

(b) the area of the sector AOB
(2 marks)

(Total for Question 1 is 3 marks)

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2. Look at the diagram for Question 2 in the Diagram Book.

It is NOT accurately drawn.

It shows triangle ABC in which

AB = 2x cm

AC = 3x cm

BC = 4x cm

(a) Show that

$$\sin ABC = \frac{3\sqrt{15}}{16}$$

(4 marks)

Given that the area of triangle ABC is

$\frac{75\sqrt{15}}{64}$ cm^2

(b) find the value of x

(2 marks)

(Total for Question 2 is 6 marks)

3. (a) Write down the value of

$\log_3 9$

(1 mark)

(b) Solve the equation

$$\log_3 9t = \log_9 \left(\frac{12}{t}\right)^2 + 2 \qquad \text{where } t > 0$$

Give your answer in the form $a\sqrt{b}$ where a and b are prime numbers.

(6 marks)

(Total for Question 3 is 7 marks)

4.

$$f(x) = e^{3x}\sqrt{1+2x}$$

(a) Show that

$$f'(x) = \frac{2e^{3x}(2+3x)}{\sqrt{1+2x}}$$

(4 marks)

(b) Find an equation of the normal to the curve with equation $y = f(x)$ at the point on the curve where $x = 0$

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

(6 marks)

(Total for Question 4 is 10 marks)

5. A circle has radius $3r$ cm and area A cm^2

Given that the value of r increases by $0 \cdot 05\%$

use calculus to find an estimate for the percentage increase in the value of A

(Total for Question 5 is 5 marks)

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6. (a) Show that

$$\sum_{r=1}^{n} (4r - 3) = n(2n - 1)$$

(3 marks)

(b) Hence, or otherwise, find the least value of n such that

$$\sum_{r=1}^{n} (4r - 3) > 1000$$

(3 marks)

Given that

$S_n = n(2n - 1)$,

$t_n = (4n - 3)$

and that $18 + 3t_{n+7} = S_{n+4}$

(c) find the value of n

(4 marks)

(Total for Question 6 is 10 marks)

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7. **O, A, B and C are fixed points such that**

$$\overrightarrow{OA} = 8\underline{i} - 6\underline{j} \qquad \overrightarrow{OB} = 15\underline{i} - 6\underline{j} \qquad \overrightarrow{OC} = 8\underline{i} + \underline{j}$$

(a) **Find $\overrightarrow{BC}$ as a simplified expression in terms of $\underline{i}$ and $\underline{j}$**

(2 marks)

(b) **Find a unit vector parallel to $\overrightarrow{BC}$**

(2 marks)

The point M is the midpoint of OA and the point N lies on OB such that ON : NB = 1 : 2

(c) **Show that the points M, N and C are collinear.**

(4 marks)

(Total for Question 7 is 8 marks)

8. (a) Look at the table for Question 8(a) in the Diagram Book.

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

There are three spaces to fill.

(2 marks)

(b) Look at the diagram for Question 8(b) in the Diagram Book.

On the grid, draw the graph of $y = 2 + \ln(2x + 1)$ for $0 \leq x \leq 3$

(2 marks)

(c) By drawing an appropriate straight line on the grid, obtain an estimate, to one decimal place, of the root of the equation $\ln(2x + 1) = 3x - 4$ in the interval $0 \leq x \leq 3$

(3 marks)

(continued on the next page)

8. continued.

(d) By drawing an appropriate straight line on the grid, obtain an estimate, to one decimal place, of the root of the equation

$e^{(6-x)} - (2x+1)^2 = 0$ in the interval

$0 \leq x \leq 3$

(4 marks)

(Total for Question 8 is 11 marks)

9. Look at the diagram for Question 9 in the Diagram Book.
It is NOT accurately drawn.

It shows a solid cuboid ABCDEFGH

AB = x cm
BC = 3x cm
AH = h cm

The volume of the cuboid is 540 cm^3

The total surface area of the cuboid is $S\text{ cm}^2$

(a) Show that
$$S = 6x^2 + \frac{1440}{x}$$
(4 marks)

(continued on the next page)

Turn over

9. continued.

Given that x can vary,

(b) use calculus to find, to 3 significant figures, the value of x for which S is a minimum.
Justify that this value of x gives a minimum value of S
(5 marks)

(c) Find, to 3 significant figures, the minimum value of S
(1 mark)

(Total for Question 9 is 10 marks)

10.

$$f(x) = 6x - x^2 \qquad x \in \mathbb{R}$$

Given that $f(x)$ can be written in the form $D(x + E)^2 + F$ where D, E and F are integers,

(a) find the value of D, the value of E and the value of F

(3 marks)

(b) Find

(i) the maximum value of $f(x)$,

(ii) the value of x for which the maximum occurs.

(2 marks)

(continued on the next page)

10. continued.

The curve C has equation $y = f(x)$

The curve S has equation

$$y = x^2 - 4x + 8$$

The curve S intersects the curve C at two points.

(c) Find the coordinates of each of these two points.

(4 marks)

The finite region R is bounded by the curve C and the curve S

(d) Use algebraic integration to find the area of R

(4 marks)

(Total for Question 10 is 13 marks)

11. The points A and B have coordinates $(-1, 3)$ and $(5, 6)$ respectively.

(a) Find an equation for the line AB

(2 marks)

The point P divides AB in the ratio $2 : 1$

(b) Show that the coordinates of P are $(3, 5)$

(2 marks)

The point C with coordinates (m, n), where $m > 0$, is such that CP is perpendicular to the line AB

Given that the radius of the circle which passes through A, P and C is 5

(c) find the value of m and the value of n

(6 marks)

(continued on the next page)

11. continued.

The point D with coordinates $(p,\ q)$ is such that the line AD is perpendicular to the line AB and the line DC is parallel to the line AB

(d) Find the value of p and the value of q

(3 marks)

(e) Find the area of trapezium $ABCD$

(4 marks)

(Total for Question 11 is 17 marks)

TOTAL FOR PAPER IS 100 MARKS

END OF PAPER
