Paper Reference 4PM1/01
Pearson Edexcel
International GCSE

Further Pure Mathematics

PAPER 1
(Calculator)

Tuesday 21 May 2024 – Morning

Time: 2 hours

YOU MUST HAVE
Nil

YOU WILL BE GIVEN
Diagram Booklet
Answer Booklet
Formulae Pages

X76506A

Calculators may be used.

INSTRUCTIONS

In the boxes on the Answer Booklet and on the Diagram Booklet, write 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 Answer Booklet – there may be more space than you need.

Do NOT write on this Question Paper.

You must NOT write anything on the Formulae Pages. Anything you write on the Formulae Pages 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.

Answer all TEN questions.

Write your answers in the Answer Booklet.

You must write down all the stages in your working.

1. In triangle ABC,

$AB = 2x$ cm, $BC = 3x$ cm and $AC = 4x$ cm

The area of triangle ABC is 50 cm^2

Find, to 2 decimal places, the value of x

(Total for Question 1 is 4 marks)

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2. $f(x) = 2x^2 + 4x + 9$

Given that $f(x)$ can be written in the form $A(x + B)^2 + C$, where A, B and C are integers,

(a) find the value of A, the value of B and the value of C

(3 marks)

(b) Hence, or otherwise, find

(i) the value of x for which $\dfrac{1}{f(x)}$ is a maximum

(ii) the maximum value of $\dfrac{1}{f(x)}$

(2 marks)

(Total for Question 2 is 5 marks)

3. (a) Show that

$$\sum_{r=1}^{n}(5r-3) = \frac{n}{2}(5n-1)$$

(3 marks)

(b) Hence, or otherwise, evaluate

$$\sum_{r=31}^{60}(5r-3)$$

(2 marks)

Given that

$$\sum_{r=1}^{n}(5r-3) = 3783$$

(c) find the value of n

(3 marks)

(Total for Question 3 is 8 marks)

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4. The surface area of a sphere with radius r cm is increasing at a constant rate of 50π cm^2/s

Find, in cm^3, the exact volume of the sphere at the instant when the rate of increase of r is $\frac{5}{12}$ cm/s

(Total for Question 4 is 8 marks)

5. A particle P is moving along the x–axis.
At time t seconds $(t \geq 0)$ the acceleration, a m/s^2, of P is given by $a = 3t - 4$

When
$t = 0$,
P is at rest.

(a) Find the velocity of P when
$t = 4$
(3 marks)

At time T seconds, $T > 0$, P is instantaneously at rest.

(b) Find the value of T
(2 marks)

(continued on the next page)

5. continued.

When

$t = 0$,

P is at the point with coordinates $(-10, 0)$

(c) Find the displacement of P from the origin when

$t = 3$

(4 marks)

(Total for Question 5 is 9 marks)

6. The line L passes through the point A with coordinates
$(-2, 2)$ and the point B with coordinates
$(3, 12)$
The point C with coordinates
(p, q) lies on L such that
$AC : CB = 3 : 2$

(a) Find the value of p and the value of q
(2 marks)

The line k is perpendicular to L and passes through the point C

(b) Show that an equation of k is
$$2y + x - 17 = 0$$
(4 marks)

(continued on the next page)

6. continued.

The line k crosses the x–axis at the point D

(c) Find the exact length of CD

(3 marks)

The point X with coordinates (m, n) lies on L such that

area of triangle $DXC = 80$ units^2

Given that

$m > 0$

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

(7 marks)

(Total for Question 6 is 16 marks)

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7. Look at the diagram for Question 7 in the Diagram Booklet.

It is NOT accurately drawn.

It shows a sketch of part of the curve C with equation

$$y = \frac{x^2}{4} - 3\sqrt{x} + 8$$

The point P lies on C and has coordinates (4, a)

(a) Show that

$a = 6$

(1 mark)

The line L is the normal to C at the point P

(b) Show that an equation of L is

$5y + 4x - 46 = 0$

(6 marks)

(continued on the next page)

7. continued.

The finite region R is bounded by the curve C, the line L, the x–axis and the line with equation $x = 1$

(c) Use calculus to find the exact area of R

(6 marks)

(Total for Question 7 is 13 marks)

8. The sum of the first and second terms of a geometric series G is 400

The sum of the second and third terms of G is 100

(a) Show that the common ratio of G is $\frac{1}{4}$

(4 marks)

(b) Show that the first term of G is 320

(2 marks)

(c) Find the sum to infinity of G

(2 marks)

The sum to n terms of G is S_n

(d) Find, using logarithms, the least value of n such that

$$S_n > 426 \cdot 6$$

(4 marks)

(Total for Question 8 is 12 marks)

9. (a) Find the value of a such that

$$\log_a 8 = \frac{3}{4}$$

(2 marks)

(b) Show that

$$3x\log_2 x - 4\log_{16} 8 + 6x\log_4 8 - \log_2 x = \log_2 (8x)^{3x-1}$$

(4 marks)

(c) Hence solve the equation

$$3x\log_2 x - 4\log_{16} 8 + 6x\log_4 8 - \log_2 x = 0$$

(3 marks)

(Total for Question 9 is 9 marks)

10. The curve C has equation

$y = \dfrac{ax - 5}{b - x}$ where a and b are integers and

$x \neq b$

One intersection of C with the coordinate axes is at the point with coordinates

$$\left(\frac{5}{4}, 0\right)$$

The asymptote parallel to the y–axis has equation $x = 3$

(a) Find the value of a and the value of b

(2 marks)

(b) Sketch C, showing clearly the asymptotes with their equations and the coordinates of the points of intersection with the coordinate axes. There are blank axes on pages 34–45 in the Answer Booklet if you wish to use them.

(5 marks)

(continued on the next page)

10. continued.

The straight line L with equation

$4y - 7x = k$ has no points of intersection with C

(c) Show, using algebra, that the range of possible values of k can be written as

$$m < k < n$$

where m and n are integers to be found.

(9 marks)

(Total for Question 10 is 16 marks)

TOTAL FOR PAPER IS 100 MARKS

END OF PAPER
