

**Paper Reference 4PM1/02  
Pearson Edexcel  
International GCSE**

**Further Pure Mathematics  
PAPER 2  
(Calculator)**

**Time: 2 hours plus your additional time allowance.**

**ITEMS INCLUDED WITH QUESTION PAPER**

**Diagram Book**

**Answer Book**

**Formulae Pages**

**Q66025A**

**Calculators may be used.**

**INSTRUCTIONS**

**In the boxes on the Answer Book and on the Diagram Book, 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 Book or on the separate diagrams – there may be more space than you need.**

**Do NOT write on the 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.

You may be provided with a model for Question 9  
It is **NOT** accurate.

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.

Good luck with your examination.

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**4**

**Answer all ELEVEN questions.**

**Write your answers in the Answer Book.**

**You must write down all the stages in your working.**

**Turn over**

1. Find the set of values for  $x$  for which

(a)  $8x - 7 < 5x + 5$

(2 marks)

(b)  $2x^2 - 5x - 3 > 0$

(3 marks)

(c) BOTH  $8x - 7 < 5x + 5$  AND  $2x^2 - 5x - 3 > 0$

(1 mark)

(Total for Question 1 is 6 marks)

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2.  $f(x) = 2 + \frac{4}{5}x - \frac{1}{25}x^2$

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

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

(4 marks)

(b) Hence write down

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

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

(2 marks)

(Total for Question 2 is 6 marks)

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3. Look at the diagram for Question 3(a) in the Diagram Book.

It is NOT accurately drawn.

It shows a sector **OPQ** of a circle with centre **O**

The radius of the circle is **18 cm** and the angle **POQ** is  $\frac{2\pi}{3}$  radians.

- (a) Find the length of the arc **PQ**, giving your answer as a multiple of  $\pi$   
(2 marks)

(continued on the next page)

3. continued.

Look at the diagram for Question 3(b) in the Diagram Book.

It is NOT accurately drawn.

It shows the sector **OPQ** and the kite **OPTQ**

**PT** is the tangent to the circle at **P** and **QT** is the tangent at **Q**, such that angle **PTQ** =  $\alpha$  radians.

(b) (i) Find  $\alpha$  in terms of  $\pi$

(1 mark)

(ii) Calculate, to 3 significant figures, the area of the region, shown shaded in the diagram, which is bounded by the arc **PQ** and the tangents **PT** and **QT**

(6 marks)

(Total for Question 3 is 9 marks)

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4. The point **A** has coordinates  $(-4, -10)$  and the point **B** has coordinates  $(3, 11)$

The line **L** passes through **A** and **B**

- (a) Find an equation of **L**  
(2 marks)

The point **P** lies on **L** such that  $AP : PB = 3 : 4$

- (b) Find the coordinates of **P**  
(2 marks)

The point **Q** with coordinates  $(m, n)$ , where  $m < 0$ , lies on the line through **P** that is perpendicular to **L**

Given that the length of **PQ** is  $\sqrt{10}$

- (c) find the coordinates of **Q**  
(6 marks)

(continued on the next page)

4. continued.

The point **R** has coordinates  $(-11, -21)$

(d) Show that

(i) **AB** and **RQ** are equal in length,

(ii) **AB** and **RQ** are parallel.

(4 marks)

(e) Find the area of the quadrilateral **ABQR**

(2 marks)

(Total for Question 4 is 16 marks)

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5. The  $n$ th term of a geometric series with common ratio  $r$  is  $u_n$

Given that  $u_2 + u_4 = 212 \cdot 5$  and that  
 $u_3 + u_4 = 62 \cdot 5$

- (a) find the two possible values of  $r$   
(5 marks)

Given that the series is convergent with sum to infinity  $S$ ,

- (b) find the exact value of  $S$   
(2 marks)

(Total for Question 5 is 7 marks)

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6.  $f(x) = x^3 + (p + 1)x^2 - 10x + q$

where  $p$  and  $q$  are integers.

Given that  $(x - 3)$  is a factor of  $f(x)$

(a) show that  $9p + q + 6 = 0$

(3 marks)

Given that  $(x + p)$ , where  $p > 0$ , is also a factor of  $f(x)$

(b) show that  $p^2 + 10p + q = 0$

(3 marks)

(c) Hence find the value of  $p$  and the value of  $q$

(5 marks)

(d) Using your values of  $p$  and  $q$ , factorise  $f(x)$  completely.

(2 marks)

(Total for Question 6 is 13 marks)

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7. (a) Look at the table for Question 7(a) in the Diagram Book.

Complete the table of values for

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

Give your answers to **2** decimal places where appropriate.

There are three spaces to fill.

(2 marks)

(continued on the next page)

7. continued.

(b) Look at the diagram for Questions 7(b) and (c) in the Diagram Book.

It shows a grid.

On the grid, draw the graph of

$$y = 3^{\frac{x}{4}} + 2 \quad \text{for } 0 \leq x \leq 5$$

(2 marks)

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

$$\log_3(6 - 2x)^4 - x = 0$$

in the interval  $0 \leq x \leq 5$

(5 marks)

(Total for Question 7 is 9 marks)

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Turn over

8. Use an algebraic method to solve the simultaneous equations

$$\log_4 a + 3 \log_8 b = \frac{5}{2}$$

$$2^a = \frac{16^4}{4^{b^2}}$$

(Total for Question 8 is 8 marks)

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9. Look at the diagram for Question 9 in the Diagram Book.

You may be provided with a model.

They are NOT accurate.

They show a metal solid **S**

The solid is a right triangular prism.

The cross section of **S** is an equilateral triangle with sides of length **x cm**

The length of **S** is **4x cm**

The prism is being heated so that the cross sectional area is increasing at a constant rate of  **$0.03 \text{ cm}^2/\text{s}$**

(a) Find, giving your answer to **3** significant figures,  $\frac{dx}{dt}$  when  **$x = 2$**   
(5 marks)

(continued on the next page)

Turn over

9. continued.

(b) Find the rate of increase, in  $\text{cm}^3/\text{s}$ , of the volume of **S** when  $x = 2$

(3 marks)

(Total for Question 9 is 8 marks)

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10. (a) Solve the equation

$$\tan x^\circ = -3 \quad \text{for } 0 \leq x < 360$$

Give your solutions to the nearest whole number.

(3 marks)

Given that

$$7 \sin^2 \theta + \sin \theta \cos \theta = 6$$

(b) show that

$$\tan^2 \theta + \tan \theta - 6 = 0$$

(3 marks)

(continued on the next page)

10. continued.

(c) Hence solve the equation

$$7 \sin^2 y^\circ + \sin y^\circ \cos y^\circ = 6$$

for  $0 \leq y < 360$

Give your solutions to the nearest whole number.

(4 marks)

(Total for Question 10 is 10 marks)

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11. Look at the diagram for Question 11 in the Diagram Book.

It is NOT accurately drawn.

It shows a graph.

The region  $R$ , shown shaded in the diagram, is bounded by the curve with equation  $y = e^x$ , the curve with equation  $y = 4e^{-x}$ , the straight line with equation  $x = a$ , the  $x$ -axis and the  $y$ -axis.

When the region  $R$  is rotated through  $360^\circ$  about the  $x$ -axis, the volume of the solid generated is

$$k - 8\pi e^{-4}$$

where  $k$  is a constant.

Using algebraic integration, find a possible value of  $a$  and the exact corresponding value of  $k$

(Total for Question 11 is 8 marks)

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**TOTAL FOR PAPER IS 100 MARKS**

**END OF PAPER**

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