

**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**

**Y66025A**

**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.**

**Turn over**

**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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**5**

**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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Turn over

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

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)

(continued on the next page)

Turn over

**2. continued.**

**(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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**Turn over**

**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)**

**Turn over**

**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.**

**(continued on the next page)**

**Turn over**

**3. continued.**

**(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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**Turn over**

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)

(continued on the next page)

Turn over

4. continued.

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)

(continued on the next page)

Turn over

4. continued.

(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  $u_2 + u_4 = 212.5$  and that  $u_3 + u_4 = 62.5$

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

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)

(continued on the next page)

Turn over

**6. continued.**

**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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**Turn over**

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)

Turn over

**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)**

**(continued on the next page)**

**Turn over**

**7. continued.**

**(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**

(continued on the next page)

Turn over

9. continued.

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)

(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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Turn over

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)

(continued on the next page)

Turn over

10. continued.

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)

Turn over

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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Turn over

**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.**

**(continued on the next page)**

**Turn over**

11. continued.

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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