

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

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

**Thursday 20 June 2019 – Morning**

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

**Items included with Question Paper:**

**Diagram Book  
Answer Book  
Formulae Pages**

**X58373A**

**Calculators may be used.**

## **INSTRUCTIONS**

**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.**

**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 11**

**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.**

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**Answer all ELEVEN questions.**

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

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

1. Referred to a fixed origin  $O$ , the point  $A$  has position vector  $(4\underline{i} + 3\underline{j})$  and the point  $B$  has position vector  $(\underline{i} + 7\underline{j})$
- (a) Find  $\overrightarrow{AB}$  as a simplified expression in terms of  $\underline{i}$  and  $\underline{j}$   
(2 marks)
- (b) Find a unit vector that is parallel to  $\overrightarrow{AB}$   
(2 marks)

(Total for Question 1 is 4 marks)

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6

2. Oil is leaking from a pipe and forms a circular pool on a horizontal surface.

The area of the surface of the pool is increasing at a constant rate of  $8 \text{ cm}^2/\text{s}$

Find, in  $\text{cm}/\text{s}$  to 3 significant figures, the rate at which the radius of the pool is increasing when the area of the pool is  $50 \text{ cm}^2$

(Total for Question 2 is 6 marks)

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Turn over

3. A particle **P** moves in a straight line.

At time **t** seconds, the velocity, **v** m/s, of **P** is given by

$$v = t^2 - 4t + 7$$

(a) Find the acceleration of **P**, in  $\text{m/s}^2$ , when **t** = 3  
(2 marks)

(b) Find the distance, in metres, that **P** travels in the interval  $0 \leq t \leq 6$   
(4 marks)

(Total for Question 3 is 6 marks)

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4. In triangle **ABC**,  
**AB = 5x cm**  
**BC = (3x – 1) cm**  
**AC = (2x + 5) cm** and  
**angle ABC = 60°**

Find, to **3 significant figures**, the value of **x**

(Total for Question 4 is 5 marks)

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5. Use algebra to solve the equations

$$xy = 36$$

$$xy + x + 2y = 53$$

(Total for Question 5 is 6 marks)

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6. (a) Given that

$$y = (4x - 3)e^{2x}$$

(i) find  $\frac{dy}{dx}$   
(3 marks)

(ii) show that

$$(4x - 3) \frac{dy}{dx} = (8x - 2)y$$

(2 marks)

(b) Differentiate

$$\frac{\sin 5x}{(x - 3)^2}$$

with respect to  $x$

(3 marks)

(Total for Question 6 is 8 marks)

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7. The sum of the first  $n$  terms of an arithmetic series is  $A_n$  where

$$A_n = \sum_{r=1}^n (4r + 5)$$

- (a) For this arithmetic series, find

(i) the first term,

(ii) the common difference.

(2 marks)

(continued on the next page)

7. continued.

The sum of the first  $n$  terms of a geometric series is  $G_n$  where

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

(b) For this geometric series, find

(i) the first term,

(ii) the common ratio.

(2 marks)

(c) Find the value of  $n$  for which

$$A_{14} - 6 = G_n$$

(5 marks)

(Total for Question 7 is 9 marks)

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8. The point **A** has coordinates **(2, 6)**,  
the point **B** has coordinates **(6, 8)** and  
the point **C** has coordinates **(4, 2)**

(a) Find the exact length of

(i) **AB**

(ii) **BC**

(iii) **AC**

(4 marks)

(b) Find the size of each angle of triangle **ABC** in  
degrees.

(3 marks)

The points **A**, **B** and **C** lie on a circle with centre **P**

(c) Find the coordinates of **P**

(2 marks)

(continued on the next page)

Turn over

8. continued.

(d) Find the exact length of the radius of the circle in the form  $\sqrt{a}$ , where  $a$  is an integer.

(2 marks)

(Total for Question 8 is 11 marks)

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9. The curve **C**, with equation  $y = f(x)$ , passes through the point with coordinates  $\left(-2, -\frac{28}{3}\right)$

Given that

$$f'(x) = x^3 - x^2 - 4x + 4$$

- (a) show that **C** passes through the origin.

(4 marks)

- (b) (i) Show that **C** has a minimum point at  $x = 2$  and a maximum point at  $x = 1$

- (ii) Find the exact value of the **y** coordinate at each of these points.

(7 marks)

(continued on the next page)

9. continued.

The curve has another turning point at **A**

(c) (i) Find the coordinates of **A**

(ii) Determine the nature of this turning point.

(3 marks)

(Total for Question 9 is 14 marks)

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10. The roots of the equation

$$x^2 + 3x - 5 = 0 \text{ are } \alpha \text{ and } \beta$$

(a) Without solving the equation, find

(i) the value of

$$\alpha^2 + \beta^2$$

(ii) the value of

$$\alpha^4 + \beta^4$$

(5 marks)

Given that

$\alpha > \beta$  and without solving the equation

(b) show that

$$\alpha - \beta = \sqrt{29}$$

(2 marks)

(c) Factorise

$$\alpha^4 - \beta^4 \text{ completely.}$$

(3 marks)

(continued on the next page)

Turn over

10. continued.

(d) Hence find the exact value of

$$\alpha^4 - \beta^4$$

(2 marks)

Given that

$\beta^4 = p + q\sqrt{29}$  where  $p$  and  $q$  are positive constants

(e) find the value of  $p$  and the value of  $q$

(3 marks)

(Total for Question 10 is 15 marks)

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

They are NOT accurate.

You may be provided with a model.

Diagram 1 and the model show a right pyramid with vertex **V** and square base, **ABCD**, of side **16 cm**

Diagram 1(i) shows **ABCD**

The diagonals **AC** and **BD** of **ABCD** intersect at the point **O**

Diagram 1(ii) shows triangle **VAC**

**O** is marked on the line **AC**

The size of the angle **AVC** is  $90^\circ$

(a) show that the height of the pyramid is

$$8\sqrt{2} \text{ cm}$$

(4 marks)

(b) Find, in **cm**, the length of **VA**

(3 marks)

(continued on the next page)

11. continued

Diagram 1(iii) shows triangle **VAD**

- (c) Find, in **cm**, the exact length of the perpendicular from **D** onto **VA**  
(3 marks)

Diagram 1(iv) shows the triangle **VOM** where **M** is the midpoint of **AB**

Find, in degrees to one decimal place, the size of

- (d) the angle between the plane **VAB** and the base **ABCD**,  
(3 marks)
- (e) the obtuse angle between the plane **VAB** and the plane **VAD**  
(3 marks)

(Total for Question 11 is 16 marks)

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**TOTAL FOR PAPER IS 100 MARKS**

**END OF PAPER**

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