

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.

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 $(4\mathbf{i} + 3\mathbf{j})$ and the point B has position vector $(\mathbf{i} + 7\mathbf{j})$

(a) Find \overrightarrow{AB} as a simplified expression in terms of \mathbf{i} and \mathbf{j}
(2 marks)

(b) Find a unit vector that is parallel to \overrightarrow{AB}
(2 marks)

(Total for Question 1 is 4 marks)

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 cm/s to 3 significant figures, the rate at which the radius of the pool is increasing when the area of the pool is 50 cm^2

(Total for Question 2 is 6 marks)

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 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)

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)

5. Use algebra to solve the equations

$$xy = 36$$

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

(Total for Question 5 is 6 marks)

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)

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)

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)

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)

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)

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°

(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)

TOTAL FOR PAPER IS 100 MARKS

END OF PAPER
