

Write your name here

Surname

Other names

**Pearson Edexcel**  
**Level 3 GCE**

Centre Number

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# Further Mathematics

**Advanced**

**Paper 2: Core Pure Mathematics 2**

Sample Assessment Material for first teaching September 2017

**Time: 1 hour 30 minutes**

Paper Reference

**9FM0/02**

**You must have:**

Mathematical Formulae and Statistical Tables, calculator

Total Marks

**Candidates may use any calculator permitted by Pearson regulations. Calculators must not have the facility for algebraic manipulation, differentiation and integration, or have retrievable mathematical formulae stored in them.**

## Instructions

- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions and ensure that your answers to parts of questions are clearly labelled.
- Answer the questions in the spaces provided  
– *there may be more space than you need.*
- You should show sufficient working to make your methods clear.  
Answers without working may not gain full credit.
- Answers should be given to three significant figures unless otherwise stated.

## Information

- A booklet 'Mathematical Formulae and Statistical Tables' is provided.
- There are 7 questions in this question paper. The total mark for this paper is 75.
- 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.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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**Answer ALL questions. Write your answers in the spaces provided.**

1. The roots of the equation

$$x^3 - 8x^2 + 28x - 32 = 0$$

are  $\alpha$ ,  $\beta$  and  $\gamma$

Without solving the equation, find the value of

(i)  $\frac{1}{\alpha} + \frac{1}{\beta} + \frac{1}{\gamma}$

(ii)  $(\alpha + 2)(\beta + 2)(\gamma + 2)$

(iii)  $\alpha^2 + \beta^2 + \gamma^2$

(8)

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**Question 1 continued**

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**Question 2 continued**

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**(Total for Question 2 is 8 marks)**

3. (i)

$$\mathbf{M} = \begin{pmatrix} 2 & a & 4 \\ 1 & -1 & -1 \\ -1 & 2 & -1 \end{pmatrix}$$

where  $a$  is a constant.

(a) For which values of  $a$  does the matrix  $\mathbf{M}$  have an inverse?

(2)

Given that  $\mathbf{M}$  is non-singular,

(b) find  $\mathbf{M}^{-1}$  in terms of  $a$

(4)

(ii) Prove by induction that for all positive integers  $n$ ,

$$\begin{pmatrix} 3 & 0 \\ 6 & 1 \end{pmatrix}^n = \begin{pmatrix} 3^n & 0 \\ 3(3^n - 1) & 1 \end{pmatrix}$$

(6)

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**Question 3 continued**

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**(Total for Question 3 is 12 marks)**

4. A complex number  $z$  has modulus 1 and argument  $\theta$ .

(a) Show that

$$z^n + \frac{1}{z^n} = 2\cos n\theta, \quad n \in \mathbb{Z}^+ \quad (2)$$

(b) Hence, show that

$$\cos^4 \theta = \frac{1}{8}(\cos 4\theta + 4\cos 2\theta + 3) \quad (5)$$

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**Question 4 continued**

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**(Total for Question 4 is 7 marks)**

5.

$$y = \sin x \sinh x$$

- (a) Show that  $\frac{d^4 y}{dx^4} = -4y$  (4)
- (b) Hence find the first three non-zero terms of the Maclaurin series for  $y$ , giving each coefficient in its simplest form. (4)
- (c) Find an expression for the  $n$ th non-zero term of the Maclaurin series for  $y$ . (2)

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**Question 5 continued**

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**Question 6 continued**

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**(Total for Question 6 is 13 marks)**



**Question 7 continued**

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**Question 7 continued**

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**(Total for Question 7 is 17 marks)****TOTAL FOR PAPER IS 75 MARKS**