

Write your name here

Surname

Other names

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

Centre Number

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Candidate Number

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# Further Mathematics

**Advanced**

**Further Mathematics Option 2**

**Paper 4: Further Pure Mathematics 2**

Sample Assessment Material for first teaching September 2017

**Time: 1 hour 30 minutes**

Paper Reference

**9FM0/4A**

**You must have:**

Mathematical Formulae and Statistical Tables, calculator

Total Marks

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**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 8 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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**Question 3 continued**

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**(Total for Question 3 is 10 marks)**







**Question 4 continued**

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**(Total for Question 4 is 13 marks)**









**Question 5 continued**

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Lined area for writing answers.

**(Total for Question 5 is 12 marks)**









7.

$$I_n = \int_0^{\frac{\pi}{2}} \sin^n x dx, \quad n \geq 0$$

(a) Prove that, for  $n \geq 2$ ,

$$nI_n = (n-1)I_{n-2} \quad (4)$$

(b)

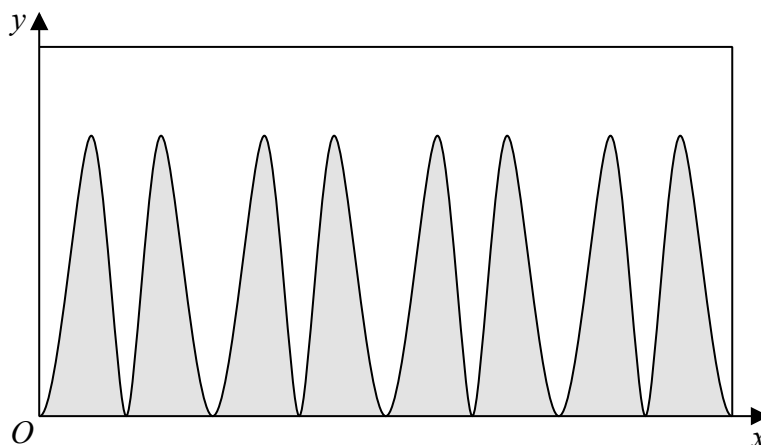


Figure 2

A designer is asked to produce a poster to completely cover the curved surface area of a solid cylinder which has diameter 1 m and height 0.7 m.

He uses a large sheet of paper with height 0.7 m and width of  $\pi$  m.

Figure 2 shows the first stage of the design, where the poster is divided into two sections by a curve.

The curve is given by the equation

$$y = \sin^2(4x) - \sin^{10}(4x)$$

relative to axes taken along the bottom and left hand edge of the paper.

The region of the poster below the curve is shaded and the region above the curve remains unshaded, as shown in Figure 2.

Find the exact area of the poster which is shaded.

(5)

**Question 7 continued**

Lined area for student response.

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8. A staircase has  $n$  steps. A tourist moves from the bottom (step zero) to the top (step  $n$ ). At each move up the staircase she can go up either one step or two steps, and her overall climb up the staircase is a combination of such moves.

If  $u_n$  is the number of ways that the tourist can climb up a staircase with  $n$  steps,

- (a) explain why  $u_n$  satisfies the recurrence relation

$$u_n = u_{n-1} + u_{n-2}, \text{ with } u_1 = 1 \text{ and } u_2 = 2 \quad (3)$$

- (b) Find the number of ways in which she can climb up a staircase when there are eight steps.

(1)

A staircase at a certain tourist attraction has 400 steps.

- (c) Show that the number of ways in which she could climb up to the top of this staircase is given by

$$\frac{1}{\sqrt{5}} \left[ \left( \frac{1 + \sqrt{5}}{2} \right)^{401} - \left( \frac{1 - \sqrt{5}}{2} \right)^{401} \right] \quad (5)$$





