

Please check the examination details below before entering your candidate information

Candidate surname

Other names

Pearson Edexcel
Level 3 GCE

Centre Number

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Candidate Number

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Time 1 hour 40 minutes

Paper
reference**8FM0/01****Further Mathematics****Advanced Subsidiary****PAPER 1: Core Pure Mathematics****You must have:**

Mathematical Formulae and Statistical Tables (Green), calculator

Total Marks

Candidates may use any calculator allowed by Pearson regulations. Calculators must not have the facility for symbolic algebra 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.
- Inexact answers should be given to three significant figures unless otherwise stated.

Information

- A booklet 'Mathematical Formulae and Statistical Tables' is provided.
- There are 9 questions in this question paper. The total mark for this paper is 80.
- 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.
- Good luck with your examination.

Turn over ►

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2. The cubic equation

$$9x^3 - 5x^2 + 4x + 7 = 0$$

has roots α , β and γ .

Without solving the equation, find the cubic equation whose roots are $(3\alpha - 2)$, $(3\beta - 2)$ and $(3\gamma - 2)$, giving your answer in the form $aw^3 + bw^2 + cw + d = 0$, where a , b , c and d are integers to be determined.

(5)

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3. (a) Use the standard results for summations to show that for all positive integers n

$$\sum_{r=1}^n (5r - 2)^2 = \frac{1}{6}n(an^2 + bn + c)$$

where a , b and c are integers to be determined.

(5)

- (b) Hence determine the value of k for which

$$\sum_{r=1}^k (5r - 2)^2 = 94k^2$$

(4)

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8. (a) Prove by induction that, for all positive integers n ,

$$\sum_{r=1}^n r(r+1)(2r+1) = \frac{1}{2}n(n+1)^2(n+2) \quad (6)$$

- (b) Hence, show that, for all positive integers n ,

$$\sum_{r=n}^{2n} r(r+1)(2r+1) = \frac{1}{2}n(n+1)(an+b)(cn+d)$$

where a , b , c and d are integers to be determined.

(3)

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9.

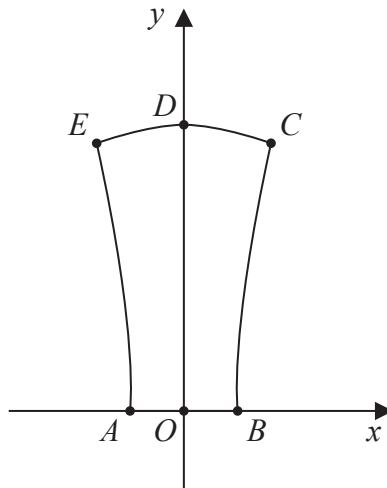


Figure 2

Figure 2 shows the vertical cross-section, $AOBCDE$, through the centre of a wax candle.

In a model, the candle is formed by rotating the region bounded by the y -axis, the line OB , the curve BC , and the curve CD through 360° about the y -axis.

The point B has coordinates $(3, 0)$ and the point C has coordinates $(5, 15)$.

The units are in centimetres.

The curve BC is represented by the equation

$$y = \frac{\sqrt{225x^2 - 2025}}{a} \quad 3 \leq x < 5$$

where a is a constant.

(a) Determine the value of a according to this model.

(2)

The curve CD is represented by the equation

$$y = 16 - 0.04x^2 \quad 0 \leq x < 5$$

(b) Using algebraic integration, determine, according to the model, the exact volume of wax that would be required to make the candle.

(9)

(c) State a limitation of the model.

(1)

When the candle was manufactured, 700 cm^3 of wax were required.

(d) Use this information and your answer to part (b) to evaluate the model, explaining your reasoning.

(1)

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