

Please check the examination details below before entering your candidate information

Candidate surname	Other names
Pearson Edexcel	Centre Number
Level 3 GCE	Candidate Number
Specimen Paper	
Paper Reference 8FM0/21	
<p style="font-size: 1.2em; margin: 0;">Further Mathematics</p> <p style="margin: 0;">Advanced Subsidiary</p> <p style="margin: 0;">21: Further Pure Mathematics 1</p>	
<p>You must have:</p> <p>Mathematical Formulae and Statistical Tables, calculator</p>	Total Marks

Candidates may use any calculator allowed by the regulations of the Joint Council for Qualifications. 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.
- Answers should be given to three significant figures unless otherwise stated.

Information

- A booklet 'Mathematical Formulae and Statistical Tables' is provided.
- There are 5 questions in this question paper. The total mark for this paper is 40.
- 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 variable y satisfies the differential equation

$$\frac{d^2y}{dx^2} = 3 + 2y^2 \frac{dy}{dx}$$

Given that $y = 1.5$ and $\frac{dy}{dx} = 2$ at $x = 1$, use the approximations

$$\left(\frac{d^2y}{dx^2}\right)_0 \approx \frac{y_1 - 2y_0 + y_{-1}}{h^2} \quad \text{and} \quad \left(\frac{dy}{dx}\right)_0 \approx \frac{y_1 - y_{-1}}{2h}$$

with $h = 0.1$, to find an estimate for y at $x = 0.9$

(5)

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2. Use algebra to find the exact set of values of x for which

$$\frac{3x}{2-x} \leq \frac{2}{x^2-4} \quad (7)$$

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Question 2 continued

Handwriting practice area with 30 horizontal lines.

(Total for Question 2 is 7 marks)

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Question 3 continued

Lined area for writing answers to Question 3.

(Total for Question 3 is 9 marks)



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4. With respect to the origin O , the points A, B, C and D have coordinates $(3, 6, 9)$, $(1, 5, 7)$, $(2, 3, 8)$ and $(3 + k, 6, 9 - k)$ respectively, where k is a non-zero constant.

(a) Show that \overrightarrow{AD} is perpendicular to the plane ABC .

(2)

The right triangular prism with face ABC and edge AD has twice the volume of the tetrahedron $OBCD$.

(b) Find the possible values of k .

(7)

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Question 4 continued

Lined writing area for the answer to Question 4.

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5.

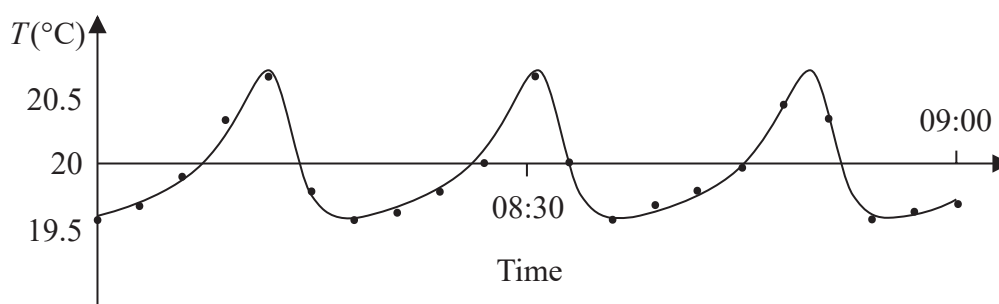


Figure 1

The temperature in a room of a house being regulated by a central heating system was recorded by an engineer every 3 minutes between 08:00 and 09:00 on a particular morning. The temperature outside at 08:00 was recorded as 15°C.

Using radians, the engineer modelled the temperature, T °C, in the room x minutes after 08:00 by the equation

$$T = \frac{119 + 38\cos\left(\frac{x}{3}\right) + 79\sin\left(\frac{x}{3}\right)}{6 + 4\sin\left(\frac{x}{3}\right) + 2\cos\left(\frac{x}{3}\right)}$$

Figure 1 shows the recorded temperatures and the graph resulting from the engineer's model.

Using the t -substitution $t = \tan\left(\frac{x}{6}\right)$

(a) show that the equation can be rewritten as

$$T = \frac{81t^2 + 158t + 157}{4t^2 + 8t + 8} \quad (3)$$

The engineer assumes that while the heating system is switched on, the equation will continue to model the temperature beyond 09:00. Given that the heating system remains switched on,

(b) use the answer to part (a) to find the proportion of time that the temperature in the room will be above 20°C according to the model. (6)

(c) Give a reason why the equation may not be suitable to model the temperature in the room beyond 09:00. (1)



Question 5 continued

Lined writing area for the answer to Question 5 continued.

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Question 5 continued

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Question 5 continued

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(Total for Question 5 is 10 marks)

TOTAL FOR PAPER IS 40 MARKS

