

Paper Reference 8FM0 – 21
Pearson Edexcel
Level 3 GCE

Further Mathematics
Advanced Subsidiary
Further Mathematics options
21: Further Pure Mathematics 1
(Part of options A, B, C and D)

Thursday 16 May 2019 – Afternoon

MATERIALS REQUIRED FOR EXAMINATION
Mathematical Formulae and Statistical Tables (Green),
calculator

ITEMS INCLUDED WITH QUESTION PAPERS
Diagram Book
Answer Book

X61862A

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

In the boxes on the Answer Book and on the Diagram Book, write 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 Answer Book or on the separate diagrams – there may be more space than you need.

Do NOT write on the Question Paper.

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.

The total mark for this part of the examination is 40

There are 5 questions.

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 4

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.

1. (a) Write down the t -formula for $\sin x$
(1 mark)

(b) Use the answer to part (a)

- (i) to find the exact value of $\sin x$ when

$$\tan\left(\frac{x}{2}\right) = \sqrt{2}$$

- (ii) to show that

$$\cos x = \frac{1-t^2}{1+t^2}$$

(4 marks)

- (c) Use the t -formulae to solve for $0 < \theta \leq 360^\circ$

$$7 \sin \theta + 9 \cos \theta + 3 = 0$$

giving your answers to one decimal place.

(4 marks)

(Total for Question 1 is 9 marks)

2. Refer to the information for Question 2 in the Diagram Book.

A student was set the following problem.

Use algebra to find the set of values of x for which

$$\frac{x}{x-24} > \frac{1}{x+11}$$

The student's attempt at a solution is written in the Diagram Book.

There are errors in the student's solution.

(a) Identify the error made

(i) in line 3

(ii) in line 7

(2 marks)

(b) Find a correct solution to this problem.

(4 marks)

(Total for Question 2 is 6 marks)

Turn over

3. Julie decides to start a business breeding rabbits to sell as pets.

Initially she buys **20** rabbits.

After t years the number of rabbits, R , is modelled by the differential equation

$$\frac{dR}{dt} = 2R + 4 \sin t \quad t > 0$$

Julie needs to have at least **40** rabbits before she can start to sell them.

Use two iterations of the approximation formula

$$\left(\frac{dy}{dx}\right)_n \approx \frac{y_{n+1} - y_n}{h}$$

to find out if, according to the model, Julie will be able to start selling rabbits after **4** months.

(Total for Question 3 is 7 marks)

4. Refer to the diagram for Question 4 in the Diagram Book.

You may be provided with a model.

The diagram shows a sketch of a solid doorstop made of wood.

The doorstop is modelled as a tetrahedron.

Relative to a fixed origin O , the vertices of the tetrahedron are $A(2, 1, 4)$, $B(6, 1, 2)$, $C(4, 10, 3)$ and $D(5, 8, d)$, where d is a positive constant and the units are in centimetres.

- (a) Find the area of the triangle ABC
(4 marks)

Given that the volume of the doorstop is 21 cm^3

- (b) find the value of the constant d
(4 marks)

(Total for Question 4 is 8 marks)

5. Refer to the diagram for Question 5 in the Diagram Book.

It shows a sketch of part of the rectangular hyperbola H with equation

$$xy = c^2 \quad x > 0$$

where C is a positive constant.

The point $P\left(ct, \frac{c}{t}\right)$ lies on H

The line L is the tangent to H at the point P

The line L crosses the x -axis at the point A and crosses the y -axis at the point B

The region R , shown shaded in the diagram, is bounded by the x -axis, the y -axis and the line L

(continued on the next page)

5. continued.

Given that the length **OB** is twice the length **OA**,
where **O** is the origin, and that the area of **R** is 32,
find the exact coordinates of the point **P**

(Total for Question 5 is 10 marks)

**TOTAL FOR FURTHER PURE MATHEMATICS 1 IS
40 MARKS**

END OF PAPER
