

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)

YOU MUST HAVE

Mathematical Formulae and Statistical Tables (Green),
calculator

YOU WILL BE GIVEN

Answer Booklet
Diagram Booklet

Q68617A

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 Booklet and on the Diagram Booklet, 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 Booklet 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.

Inexact 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.

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

$$x \geq \frac{2x + 15}{2x + 3}$$

(Total for Question 1 is 6 marks)

2. A population of deer was introduced onto an island.

The number of deer, P , on the island at time t years following their introduction is modelled by the differential equation

$$\frac{dP}{dt} = \frac{P}{5000} \left(1000 - \frac{P(t+1)}{6t+5} \right) \quad t > 0$$

It was estimated that there were **540** deer on the island six months after they were introduced.

Use **TWO** applications of the approximation formula

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

to estimate the number of deer on the island **10** months after they were introduced.

(Total for Question 2 is 7 marks)

3. (a) Use $t = \tan \frac{\theta}{2}$ to show that, where both sides are defined

$$\frac{29 - 21 \sec \theta}{20 - 21 \tan \theta} \equiv \frac{5t + 2}{2t + 5}$$

(4 marks)

- (b) Hence, again using $t = \tan \frac{\theta}{2}$, prove that, where both sides are defined

$$\frac{20 + 21 \tan \theta}{29 + 21 \sec \theta} \equiv \frac{29 - 21 \sec \theta}{20 - 21 \tan \theta}$$

(3 marks)

(Total for Question 3 is 7 marks)

4. The parabola **C** has equation $y^2 = 10x$

The point **F** is the focus of **C**

- (a) Write down the coordinates of **F**
(1 mark)

The point **P** on **C** has y coordinate q ,
where $q > 0$

- (b) Show that an equation for the tangent to **C** at **P**
is given by

$$10x - 2qy + q^2 = 0$$

(3 marks)

(continued on the next page)

4. continued.

The tangent to **C** at **P** intersects the directrix of **C** at the point **A**

The point **B** lies on the directrix such that **PB** is parallel to the **x**-axis.

(c) Show that the point of intersection of the diagonals of quadrilateral **PBAF** always lies on the **y**-axis.

(5 marks)

(Total for Question 4 is 9 marks)

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

The diagram shows the points $A(3, 2, -4)$, $B(9, -4, 2)$, $C(-6, -10, 8)$ and $D(-4, -5, 10)$ are the vertices of a tetrahedron.

The plane with equation $z = 0$ cuts the tetrahedron into two pieces, one on each side of the plane.

The edges AB , AC and AD of the tetrahedron intersect the plane at the points M , N and P respectively, as shown in the diagram.

(continued on the next page)

5. continued.

Determine

(a) the coordinates of the points **M**, **N** and **P**,
(3 marks)

(b) the area of triangle **MNP**,
(2 marks)

(c) the exact volume of the solid **BCDPNM**
(6 marks)

(Total for Question 5 is 11 marks)

TOTAL FOR FURTHER PURE MATHEMATICS 1

IS 40 MARKS

END OF PAPER
