

Please check the examination details below before entering your candidate information

Candidate surname

Other names

Centre Number

Candidate Number

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Pearson Edexcel Level 3 GCE

Paper
reference

8FM0/21



Further Mathematics

Advanced Subsidiary

Further Mathematics options

21: Further Pure Mathematics 1

(Part of options A, B, C and D)

Total Marks

You must have:

Mathematical Formulae and Statistical Tables (Green), calculator

**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.
- 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.

Turn over ▶

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Q1/1/1/



Pearson

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

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

(6)

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Question 1 continued

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(Total for Question 1 is 6 marks)



P 6 8 6 1 7 A 0 3 1 6

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.

(7)



Question 2 continued

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(Total for Question 2 is 7 marks)



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

$$\frac{29 - 21\sec \theta}{20 - 21\tan \theta} \equiv \frac{5t + 2}{2t + 5} \quad (4)$$

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

$$\frac{20 + 21\tan \theta}{29 + 21\sec \theta} \equiv \frac{29 - 21\sec \theta}{20 - 21\tan \theta} \quad (3)$$

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Question 3 continued

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(Total for Question 3 is 7 marks)



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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)

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)

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)



Question 4 continued

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Question 4 continued

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Question 4 continued

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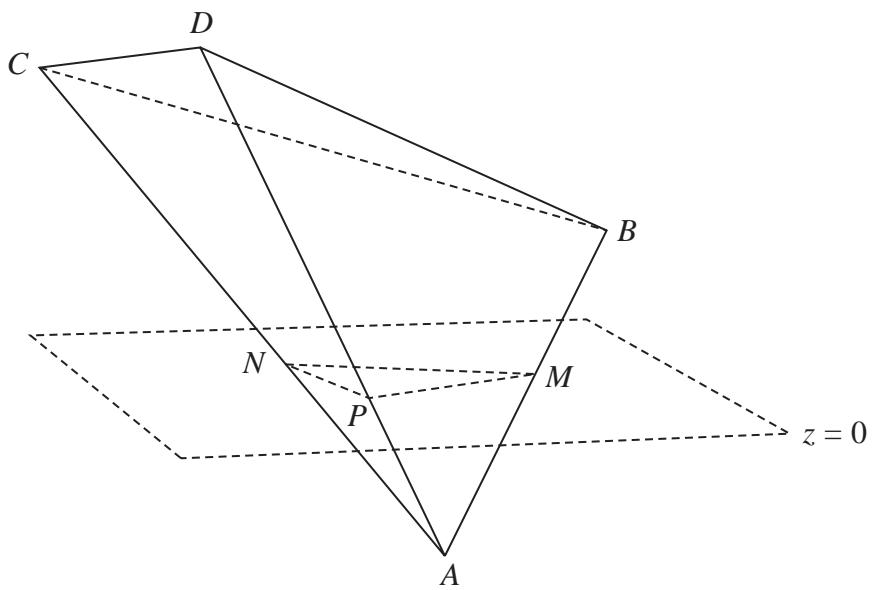
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(Total for Question 4 is 9 marks)



P 6 8 6 1 7 A 0 1 1 1 6

5.

**Figure 1**

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 Figure 1.

Determine

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

(3)

(b) the area of triangle MNP ,

(2)

(c) the exact volume of the solid $BCDPNM$.

(6)



Question 5 continued

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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 11 marks)

TOTAL FOR FURTHER PURE MATHEMATICS 1 IS 40 MARKS

