

Please check the examination details below before entering your candidate information

Candidate surname					Other names		
Pearson Edexcel		Centre Number			Candidate Number		
Level 3 GCE		<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Practice Paper 3							
(Time: 1 hour 30 minutes)				Paper Reference 9FM0/3A			
Further Mathematics							
Advanced							
Paper 3A: Further Pure Mathematics 1							
You must have: Mathematical Formulae and Statistical Tables, calculator						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.
- 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 75. There are 8 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.

Answer ALL questions.

1. An ellipse has equation $\frac{x^2}{16} + \frac{y^2}{9} = 1$.

- (a) Sketch the ellipse. (1)
- (b) Find the value of the eccentricity e . (2)
- (c) State the coordinates of the foci of the ellipse. (2)

(Total for Question 1 is 5 marks)

2. (a) Sketch, on the same axes, the graphs with equation $y = |2x - 3|$, and the line with equation $y = 5x - 1$. (2)
- (b) Solve the inequality $|2x - 3| < 5x - 1$. (3)

(Total for Question 2 is 5 marks)

3. The hyperbola H has equation $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$, where a and b are constants.

The line L has equation $y = mx + c$, where m and c are constants.

- (a) Given that L and H meet, show that the x -coordinates of the points of intersection are the roots of the equation

$$(a^2m^2 - b^2)x^2 + 2a^2mcx + a^2(c^2 + b^2) = 0. \quad (2)$$

Hence, given that L is a tangent to H ,

- (b) show that $a^2m^2 = b^2 + c^2$. (2)

The hyperbola H' has equation $\frac{x^2}{25} - \frac{y^2}{16} = 1$.

- (c) Find the equations of the tangents to H' which pass through the point $(1, 4)$. (7)

(Total for Question 3 is 11 marks)

4.
$$y \frac{d^2 y}{dx^2} + \left(\frac{dy}{dx} \right)^2 + y = 0.$$

(a) Find an expression for $\frac{d^3 y}{dx^3}$. (5)

Given that $y = 1$ and $\frac{dy}{dx} = 1$ at $x = 0$,

(b) find the series solution for y , in ascending powers of x , up to an including the term in x^3 . (5)

(c) Comment on whether it would be sensible to use your series solution to give estimates for y at $x = 0.2$ and at $x = 50$. (2)

(Total for Question 4 is 12 marks)

5. The displacement, s m, of a particle at time x seconds, is given by

$$s = 2 \sin 4x + 4 \sin 2x + 1, \quad 0 \leq x \leq 2\pi.$$

(a) Show that the velocity of the particle, v m s⁻¹, at time x seconds is given by

$$v = \frac{16}{(1+t^2)^2} (1-3t^2), \quad \text{where } t = \tan x. \quad (6)$$

(b) Hence find the least value of s in the given interval, justifying that it is a minimum. (4)

(Total for Question 5 is 10 marks)

6. (a) Show that the vector $\mathbf{i} + \mathbf{k}$ is perpendicular to the plane with vector equation

$$\mathbf{r} = \mathbf{i} + s\mathbf{j} + t(\mathbf{i} - \mathbf{k}). \quad (2)$$

(b) Find the perpendicular distance from the origin to this plane. (3)

(c) Hence or otherwise find a Cartesian equation of the plane (3)

(Total for Question 6 is 8 marks)

7. Use L'Hopital's rule to find the value of $\lim_{x \rightarrow \infty} (1 + ax)^{\frac{1}{x}}$

(Total for Question 7 is 6 marks)

8. The plane Π passes through the points
 $A(-1, -1, 1)$, $B(4, 2, 1)$ and $C(2, 1, 0)$.

- (a) Find a vector equation of the line perpendicular to Π which passes through the point $D(1, 2, 3)$. **(3)**
- (b) Find the volume of the tetrahedron $ABCD$. **(3)**
- (c) Obtain the equation of Π in the form $\mathbf{r} \cdot \mathbf{n} = p$. **(3)**

The perpendicular from D to the plane Π meets Π at the point E .

- (d) Find the coordinates of E . **(4)**
- (e) Show that $DE = \frac{11\sqrt{35}}{35}$. **(2)**

The point D' is the reflection of D in Π .

- (f) Find the coordinates of D' . **(3)**

(Total for Question 8 is 18 marks)

TOTAL FOR FURTHER PURE MATHEMATICS 1 IS 75 MARKS

Origin of questions:

1. P5 June 2002, Qn 1
2. P4 January 2003, Qn 4
3. FP3 June 2009, Qn 6
4. P6 June 2002, Qn 4
5. FP1 textbook, P191 Qn 7
6. FP1 textbook, p27 Qn 9
7. FP1 textbook, P159 Qn 7
8. P6 June 2002, Qn 7