Please check the examination details below before entering your candidate information

Candidate surname	Other names

Pearson Edexcel Level 3 GCE

Centre Number

Candidate Number

Practice Paper 5

(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 10 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. Solve the inequality $\dfrac{1}{2x+1} > \dfrac{x}{3x-2}$.

(Total for Question 1 is 6 marks)

---

2. An ellipse, with equation $\dfrac{x^2}{9} + \dfrac{y^2}{4} = 1$, has foci S and S'.

(*a*) Find the coordinates of the foci of the ellipse.

(4)

(*b*) Using the focus-directrix property of the ellipse, show that, for any point P on the ellipse,

$$SP + S'P = 6.$$

(3)

(Total for Question 2 is 7 marks)

---

3. Given that $y = \tan x$,

(*a*) find $\dfrac{\mathrm{d}y}{\mathrm{d}x}$, $\dfrac{\mathrm{d}^2 y}{\mathrm{d}x^2}$ and $\dfrac{\mathrm{d}^3 y}{\mathrm{d}x^3}$.

(3)

(*b*) Find the Taylor series expansion of $\tan x$ in ascending powers of $\left(x - \dfrac{\pi}{4}\right)$ up to and including the term in $\left(x - \dfrac{\pi}{4}\right)^3$.

(3)

(*c*) Hence show that $\tan \dfrac{3\pi}{10} \approx 1 + \dfrac{\pi}{10} + \dfrac{\pi^2}{200} + \dfrac{\pi^3}{3000}$.

(2)

(Total for Question 3 is 8 marks)

---

4. Given that n is a positive integer, find $\lim\limits_{x \to 2} \dfrac{x-2}{x^n - 2^n}$, giving your answer in terms of n.

(Total for Question 4 is 4 marks)

---

5. The line $x = 8$ is a directrix of the ellipse with equation

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1, \quad a > 0, \quad b > 0,$$

and the point (2, 0) is the corresponding focus.

Find the value of a and the value of b.

(Total for Question 5 is 5 marks)

---

6. The plane Π_1 passes through the P, with position vector $\mathbf{i} + 2\mathbf{j} - \mathbf{k}$, and is perpendicular to the line L with equation

$$\mathbf{r} = 3\mathbf{i} - 2\mathbf{k} + \lambda(-\mathbf{i} + 5\mathbf{j} + 3\mathbf{k}).$$

(*a*) Show that the Cartesian equation of Π_1 is $x - 5y - 3z = -6$.

(4)

The plane Π_2 contains the line L and passes through the point Q, with position vector $\mathbf{i} + 2\mathbf{j} + 2\mathbf{k}$.

(*b*) Find the perpendicular distance of Q from Π_1.

(4)

(*c*) Find the equation of Π_2 in the form $\mathbf{r} = \mathbf{a} + s\mathbf{b} + t\mathbf{c}$.

(4)

(Total for Question 6 is 12 marks)

---

7. The hyperbola H has equation $\frac{x^2}{16} - \frac{y^2}{4} = 1$.

The line l_1 is the tangent to H at the point $P\ (4 \sec t, 2 \tan t)$.

(*a*) Use calculus to show that an equation of l_1 is

$$2y \sin t = x - 4 \cos t$$

(5)

The line l_2 passes through the origin and is perpendicular to l_1.

The lines l_1 and l_2 intersect at the point Q.

(*b*) Show that, as t varies, an equation of the locus of Q is

$$(x^2 + y^2)^2 = 16x^2 - 4y^2$$

(8)

(Total for Question 7 is 13 marks)

---

8. The value, x thousand pounds, of a particular tradeable commodity t days after it is purchased is modelled by the differential equation

$$\frac{\mathrm{d}x}{\mathrm{d}t} = \frac{x^2 - t}{xt - t^2}$$

If the commodity is worth £5000 two days after it is purchased, use two iterations of the approximation formula $\left(\frac{\mathrm{d}y}{\mathrm{d}x}\right)_0 \approx \frac{y_1 - y_0}{h}$ to estimate, correct to the nearest hundred pounds, the value of the commodity three days after it is purchased.

(Total for Question 8 is 6 marks)

---

9. (a) Using the substitution $t = \tan\frac{\theta}{2}$, show that the equation $6\tan\theta + 12\sin\theta + \cos\theta = 1$ can be written as $t(t-2)(t^2 - 4t - 9) = 0$.

(3)

(b) Hence find all solutions of $6\tan\theta + 12\sin\theta + \cos\theta = 1$ in the range $0 \le \theta \le 2\pi$ to 2 decimal places.

(3)

(Total for Question 9 is 6 marks)

---

10. The position vectors of the points A, B and C relative to an origin O are $\mathbf{i} - 2\mathbf{j} - 2\mathbf{k}$, $7\mathbf{i} - 3\mathbf{k}$ and $4\mathbf{i} + 4\mathbf{j}$ respectively.

Find

(*a*) $\overrightarrow{AC} \times \overrightarrow{BC}$,

(4)

(*b*) the area of triangle ABC,

(2)

(*c*) an equation of the plane ABC in the form $\mathbf{r}.\,\mathbf{n} = p$.

(2)

(Total for Question 10 is 8 marks)

TOTAL FOR FURTHER PURE MATHEMATICS 1 IS 75 MARKS

Origin of questions:

1. **P4 June 2003, Qn 2**
2. **P5 June 2004, Qn 3**
3. **P6 June 2004, Qn 2**
4. **FP1 textbook p159, Qn 8**
5. **FP3 June 2010, Qn 1**
6. **P6 June 2003, Qn 7**
7. **FP3 June 2010, Qn 8**
8. **FP1 textbook, p176 Qn 3**
9. **FP1 textbook, p128 Qn 17**
10. **FP3 June 2012, Qn 3**