| Centre No. | | | | | | Paper Reference | | | | | | | Surname | Initial(s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Candidate No. | | | | | | 6 | 6 | 6 | 8 | / | 0 | 1 | Signature | |

Paper Reference(s)

**6668/01**

Examiner's use only

| | | |
|---|---|---|
| | | |

Team Leader's use only

| | | |
|---|---|---|
| | | |

# Edexcel GCE

## Further Pure Mathematics FP2

## Advanced/Advanced Subsidiary

Friday 19 June 2009 – Afternoon

Time: 1 hour 30 minutes

| Question Number | Leave Blank |
|---|---|
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| 6 | |
| 7 | |
| 8 | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| Total | |

**Materials required for examination**
Mathematical Formulae (Orange)

**Items included with question papers**
Nil

**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 to Candidates

In the boxes above, write your centre number, candidate number, your surname, initials and signature.
Check that you have the correct question paper.
Answer ALL the questions. You must write your answer to each question in the space following the question.
When a calculator is used, the answer should be given to an appropriate degree of accuracy.

### Information for Candidates

A booklet 'Mathematical Formulae and Statistical Tables' is provided.
Full marks may be obtained for answers to ALL questions.
The marks for individual questions and the parts of questions are shown in round brackets: e.g. **(2)**.
There are 8 questions in this question paper. The total mark for this question paper is 75.
There are 28 pages in this question paper. Any blank pages are indicated.

### Advice to Candidates

You must ensure that your answers to parts of questions are clearly labelled.
You should show sufficient working to make your methods clear to the Examiner.
Answers without working may not gain full credit.



Printer's Log. No.
M35144A
W850/R6668/57570 3/5/3/

M 3 5 1 4 4 A 0 1 2 8

***Turn over***

edexcel
advancing learning, changing lives

Leave blank

**1.** (a) Express $\frac{1}{r(r+2)}$ in partial fractions.

**(1)**

(b) Hence show that $\sum_{r=1}^{n} \frac{4}{r(r+2)} = \frac{n(3n+5)}{(n+1)(n+2)}$.

**(5)**

Leave blank

**Question 1 continued**

**Q1**

**(Total 6 marks)**

Leave blank

**2.** Solve the equation

$$z^3 = 4\sqrt{2} - 4\sqrt{2}\mathrm{i},$$

giving your answers in the form $r(\cos\theta + \mathrm{i}\sin\theta)$, where $-\pi < \theta \leqslant \pi$.

**(6)**

Leave blank

**Question 2 continued**

**Q2**

**(Total 6 marks)**

Leave blank

**3.** Find the general solution of the differential equation

$$\sin x \frac{\mathrm{d}y}{\mathrm{d}x} - y\cos x = \sin 2x \sin x,$$

giving your answer in the form $y = \mathrm{f}(x)$.

**(8)**

Leave blank

**Question 3 continued**

**Q3**

**(Total 8 marks)**

Leave blank

**4.**

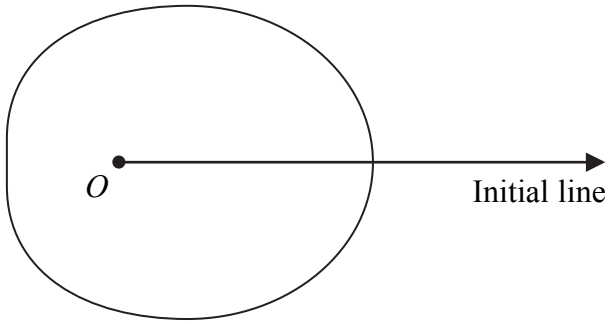


**Figure 1**

Figure 1 shows a sketch of the curve with polar equation

$$r = a + 3\cos\theta, \quad a > 0, \quad 0 \leqslant \theta < 2\pi$$

The area enclosed by the curve is $\frac{107}{2}\pi$.

Find the value of $a$.

**(8)**

Leave blank

**Question 4 continued**



Leave blank

**Question 4 continued**

Leave blank

**Question 4 continued**

**Q4**

**(Total 8 marks)**

Leave blank

**5.**

$$y = \sec^2 x$$

(a) Show that $\dfrac{\mathrm{d}^2y}{\mathrm{d}x^2} = 6\sec^4 x - 4\sec^2 x$.

**(4)**

(b) Find a Taylor series expansion of $\sec^2 x$ in ascending powers of $\left(x - \dfrac{\pi}{4}\right)$, up to and including the term in $\left(x - \dfrac{\pi}{4}\right)^3$.

**(6)**

Leave blank

**Question 5 continued**



Leave blank

**Question 5 continued**

Leave blank

**Question 5 continued**

**Q5**

**(Total 10 marks)**



Leave blank

**6.** A transformation $T$ from the $z$-plane to the $w$-plane is given by

$$w = \frac{z}{z + \mathrm{i}}, \quad z \neq -\mathrm{i}$$

The circle with equation $|z| = 3$ is mapped by $T$ onto the curve $C$.

(a) Show that $C$ is a circle and find its centre and radius.

**(8)**

The region $|z| < 3$ in the $z$-plane is mapped by $T$ onto the region $R$ in the $w$-plane.

(b) Shade the region $R$ on an Argand diagram.

**(2)**

Leave blank

**Question 6 continued**



Leave blank

**Question 6 continued**

Leave blank

**Question 6 continued**

**Q6**

**(Total 10 marks)**



Leave blank

**7.** (a) Sketch the graph of $y = |x^2 - a^2|$, where $a > 1$, showing the coordinates of the points where the graph meets the axes.

**(2)**

(b) Solve $|x^2 - a^2| = a^2 - x, \ a > 1$.

**(6)**

(c) Find the set of values of $x$ for which $|x^2 - a^2| > a^2 - x, \ a > 1$.

**(4)**

Leave blank

**Question 7 continued**



Leave blank

**Question 7 continued**

Leave blank

**Question 7 continued**

**Q7**

**(Total 12 marks)**



Leave blank

**8.**

$$\frac{d^2x}{dt^2} + 5\frac{dx}{dt} + 6x = 2e^{-t}$$

Given that $x = 0$ and $\frac{dx}{dt} = 2$ at $t = 0$,

(a) find $x$ in terms of $t$.

**(8)**

The solution to part (a) is used to represent the motion of a particle $P$ on the $x$-axis. At time $t$ seconds, where $t > 0$, $P$ is $x$ metres from the origin $O$.

(b) Show that the maximum distance between $O$ and $P$ is $\frac{2\sqrt{3}}{9}$ m and justify that this distance is a maximum.

**(7)**

Leave blank

**Question 8 continued**



Leave blank

**Question 8 continued**

Leave blank

**Question 8 continued**



Leave blank

**Question 8 continued**

**Q8**

**(Total 15 marks)**

**TOTAL FOR PAPER: 75 MARKS**

**END**