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

Paper Reference(s)

**6668/01**

# Edexcel GCE

## Further Pure Mathematics FP2

## Advanced/Advanced Subsidiary

Wednesday 3 June 2015 – Morning

Time: 1 hour 30 minutes

Examiner's use only

Team Leader's use only

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

| Materials required for examination | Items included with question papers |
|---|---|
| Mathematical Formulae (Pink) | 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 or symbolic differentiation/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 paper is 75.
There are 32 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.



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PEARSON

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**1.** (a) Use algebra to find the set of values of $x$ for which

$$x + 2 > \frac{12}{x + 3}$$

**(6)**

(b) Hence, or otherwise, find the set of values of $x$ for which

$$x + 2 > \frac{12}{|x + 3|}$$

**(1)**

Leave blank

**Question 1 continued**

Leave blank

**2.**

$$z = -2 + \left(2\sqrt{3}\right)\mathrm{i}$$

(a) Find the modulus and the argument of $z$.

**(3)**

Using de Moivre's theorem,

(b) find $z^6$, simplifying your answer,

**(2)**

(c) find the values of $w$ such that $w^4 = z^3$, giving your answers in the form $a + \mathrm{i}b$ where $a, b \in \mathbb{R}$.

**(4)**

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**Question 2 continued**

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**3.** Find, in the form $y = \mathrm{f}(x)$, the general solution of the differential equation

$$\tan x \frac{\mathrm{d}y}{\mathrm{d}x} + y = 3\cos 2x \tan x, \qquad 0 < x < \frac{\pi}{2}$$

**(6)**

Leave blank

**4.** (a) Show that

$$r^2(r+1)^2 - (r-1)^2\,r^2 \equiv 4r^3$$

**(3)**

Given that $\sum_{r=1}^{n} r = \frac{1}{2}n(n+1)$

(b) use the identity in (a) and the method of differences to show that

$$(1^3 + 2^3 + 3^3 + \ldots + n^3) = (1 + 2 + 3 + \ldots + n)^2$$

**(4)**

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**Question 4 continued**



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

$$w = \frac{z}{z + 3\text{i}}, \quad z \neq -3\text{i}$$

The circle with equation $|z| = 2$ is mapped by $T$ onto the curve $C$.

(a) (i) Show that $C$ is a circle.

(ii) Find the centre and radius of $C$.

**(8)**

The region $|z| \leqslant 2$ 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)**

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**Question 5 continued**



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**6.**

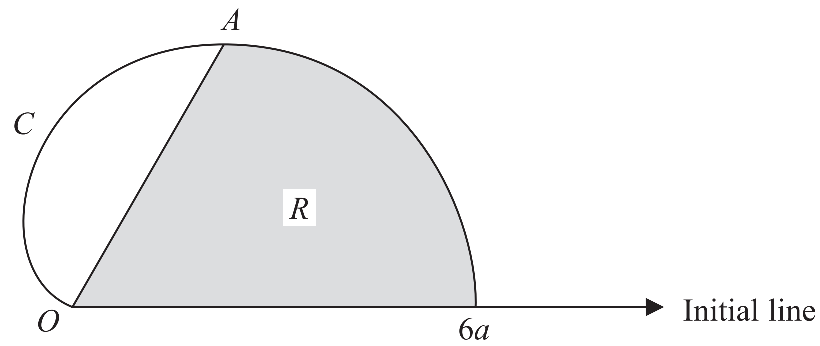


**Figure 1**

The curve $C$, shown in Figure 1, has polar equation

$$r = 3a\,(1 + \cos\theta), \qquad 0 \leqslant \theta < \pi$$

The tangent to $C$ at the point $A$ is parallel to the initial line.

(a) Find the polar coordinates of $A$.

**(6)**

The finite region $R$, shown shaded in Figure 1, is bounded by the curve $C$, the initial line and the line $OA$.

(b) Use calculus to find the area of the shaded region $R$, giving your answer in the form $a^2\left(p\pi + q\sqrt{3}\right)$, where $p$ and $q$ are rational numbers.

**(5)**

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**Question 6 continued**



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**7.**

$$y = \tan^2 x, \qquad -\frac{\pi}{2} < x < \frac{\pi}{2}$$

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

**(4)**

(b) Hence show that $\dfrac{d^3y}{dx^3} = 8\sec^2 x \tan x\,(A\sec^2 x + B)$, where $A$ and $B$ are constants to be found.

**(3)**

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

**(4)**

Leave blank

**Question 7 continued**

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**8.** (a) Show that the transformation $x = e^u$ transforms the differential equation

$$x^2\frac{d^2y}{dx^2} - 7x\frac{dy}{dx} + 16y = 2\ln x, \qquad x > 0 \qquad \text{(I)}$$

into the differential equation

$$\frac{d^2y}{du^2} - 8\frac{dy}{du} + 16y = 2u \qquad \text{(II)}$$

**(6)**

(b) Find the general solution of the differential equation (II), expressing $y$ as a function of $u$.

**(7)**

(c) Hence obtain the general solution of the differential equation (I).

**(1)**

Leave blank

**Question 8 continued**



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