Centre No.						Paper Reference							Surname	Initial(s)
Candidate No.						6	6	6	7	/	0	1	Signature	

Paper Reference(s)

6667/01

Edexcel GCE

Further Pure Mathematics FP1

Advanced/Advanced Subsidiary

Monday 31 January 2011 – Afternoon

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	
9	
10	
Total	

Materials required for examination
Mathematical Formulae (Pink)

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 10 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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1. $$z = 5 - 3\text{i}, \qquad w = 2 + 2\text{i}$$

Express in the form $a + b\text{i}$, where a and b are real constants,

(a) z^2,

(2)

(b) $\dfrac{z}{w}$.

(3)

Q1

(Total 5 marks)

N 3 5 4 0 6 A 0 2 3 2

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2.

$$\mathbf{A} = \begin{pmatrix} 2 & 0 \\ 5 & 3 \end{pmatrix}, \quad \mathbf{B} = \begin{pmatrix} -3 & -1 \\ 5 & 2 \end{pmatrix}$$

(a) Find **AB**.

(3)

Given that

$$\mathbf{C} = \begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}$$

(b) describe fully the geometrical transformation represented by **C**,

(2)

(c) write down $\mathbf{C}^{100}$.

(1)

Q2

(Total 6 marks)

Leave blank

3. $$f(x) = 5x^2 - 4x^{\frac{3}{2}} - 6, \quad x \geqslant 0$$

The root α of the equation $f(x) = 0$ lies in the interval $[1.6, 1.8]$.

(a) Use linear interpolation once on the interval $[1.6, 1.8]$ to find an approximation to α. Give your answer to 3 decimal places.

(4)

(b) Differentiate $f(x)$ to find $f'(x)$.

(2)

(c) Taking 1.7 as a first approximation to α, apply the Newton-Raphson process once to $f(x)$ to obtain a second approximation to α. Give your answer to 3 decimal places.

(4)

N 3 5 4 0 6 A 0 4 3 2

Leave blank

Question 3 continued

Leave blank

Question 3 continued

N 3 5 4 0 6 A 0 6 3 2

Leave blank

Question 3 continued

(Total 10 marks)

Q3

Leave blank

4. Given that 2 – 4i is a root of the equation

$$z^2 + pz + q = 0,$$

where p and q are real constants,

(a) write down the other root of the equation,

(1)

(b) find the value of p and the value of q.

(3)

N 3 5 4 0 6 A 0 8 3 2

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Question 4 continued

Q4

(Total 4 marks)

Leave blank

5. (a) Use the results for $\sum_{r=1}^{n} r$, $\sum_{r=1}^{n} r^2$ and $\sum_{r=1}^{n} r^3$, to prove that

$$\sum_{r=1}^{n} r(r+1)(r+5) = \frac{1}{4}n(n+1)(n+2)(n+7)$$

for all positive integers n.

(5)

(b) Hence, or otherwise, find the value of

$$\sum_{r=20}^{50} r(r+1)(r+5)$$

(2)

N 3 5 4 0 6 A 0 1 0 3 2

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Question 5 continued

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Question 5 continued

N 3 5 4 0 6 A 0 1 2 3 2

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Question 5 continued

Q5

(Total 7 marks)

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6.

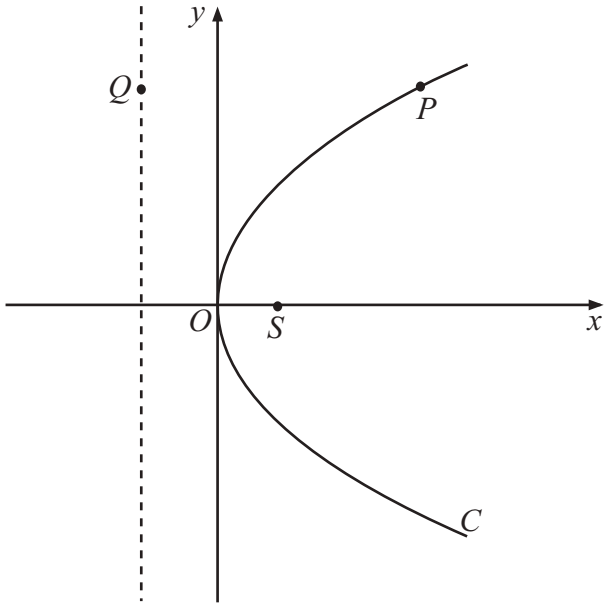

Figure 1

Figure 1 shows a sketch of the parabola C with equation $y^2 = 36x$.
The point S is the focus of C.

(a) Find the coordinates of S.

(1)

(b) Write down the equation of the directrix of C.

(1)

Figure 1 shows the point P which lies on C, where $y > 0$, and the point Q which lies on the directrix of C. The line segment QP is parallel to the x-axis.

Given that the distance PS is 25,

(c) write down the distance QP,

(1)

(d) find the coordinates of P,

(3)

(e) find the area of the trapezium $OSPQ$.

(2)

N 3 5 4 0 6 A 0 1 4 3 2

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Question 6 continued

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Question 6 continued

N 3 5 4 0 6 A 0 1 6 3 2

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Question 6 continued

Q6

(Total 8 marks)

Leave blank

7. $$z = -24 - 7\text{i}$$

(a) Show z on an Argand diagram.

(1)

(b) Calculate arg z, giving your answer in radians to 2 decimal places.

(2)

It is given that

$$w = a + b\text{i}, \quad a \in \mathbb{R},\ b \in \mathbb{R}$$

Given also that $|w| = 4$ and $\arg w = \dfrac{5\pi}{6}$,

(c) find the values of a and b,

(3)

(d) find the value of $|zw|$.

(3)

N 3 5 4 0 6 A 0 1 8 3 2

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Question 7 continued

Leave blank

Question 7 continued

N 3 5 4 0 6 A 0 2 0 3 2

Leave blank

Question 7 continued

Q7

(Total 9 marks)

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8.

$$\mathbf{A} = \begin{pmatrix} 2 & -2 \\ -1 & 3 \end{pmatrix}$$

(a) Find det **A**.

(1)

(b) Find $\mathbf{A}^{-1}$.

(2)

The triangle R is transformed to the triangle S by the matrix **A**.
Given that the area of triangle S is 72 square units,

(c) find the area of triangle R.

(2)

The triangle S has vertices at the points $(0, 4)$, $(8, 16)$ and $(12, 4)$.

(d) Find the coordinates of the vertices of R.

(4)

Leave blank

Question 8 continued

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Question 8 continued

N 3 5 4 0 6 A 0 2 4 3 2

Leave blank

Question 8 continued

Q8

(Total 9 marks)

Leave blank

9. A sequence of numbers $u_1, u_2, u_3, u_4, \ldots$ is defined by

$$u_{n+1} = 4u_n + 2, \quad u_1 = 2$$

Prove by induction that, for $n \in \mathbb{Z}^+$,

$$u_n = \frac{2}{3}\left(4^n - 1\right)$$

(5)

N 3 5 4 0 6 A 0 2 6 3 2

Leave blank

Question 9 continued

Q9

(Total 5 marks)

Leave blank

10. The point $P\left(6t, \frac{6}{t}\right)$, $t \neq 0$, lies on the rectangular hyperbola H with equation $xy = 36$.

(a) Show that an equation for the tangent to H at P is

$$y = -\frac{1}{t^2}x + \frac{12}{t}$$

(5)

The tangent to H at the point A and the tangent to H at the point B meet at the point $(-9, 12)$.

(b) Find the coordinates of A and B.

(7)

N 3 5 4 0 6 A 0 2 8 3 2

Leave blank

Question 10 continued

Leave blank

Question 10 continued

N 3 5 4 0 6 A 0 3 0 3 2

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Question 10 continued

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Question 10 continued

Q10

(Total 12 marks)

TOTAL FOR PAPER: 75 MARKS

END

N 3 5 4 0 6 A 0 3 2 3 2