Centre No.						Paper Reference							Surname	Initial(s)
Candidate No.						6	6	7	4	/	0	1	Signature	

Paper Reference(s)

6674/01

Edexcel GCE

Further Pure Mathematics FP1

Advanced/Advanced Subsidiary

Friday 30 January 2009 – 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	

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1. (a) Show that $\sum_{r=1}^{n}(r^2-r-1)=\frac{1}{3}n(n^2-4)$.

(4)

(b) Hence, or otherwise, find the value of $\sum_{r=10}^{20}(r^2-r-1)$.

(2)

Question 1 continued

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(Total 6 marks)

Q1

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2. $f(x) = 2x^4 - 14x^3 + 33x^2 - 26x + 10.$

Given that $x = 3 + i$ is a solution of the equation $f(x) = 0$, solve $f(x) = 0$ completely.

(6)

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Question 2 continued

(Total 6 marks)

Q2

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3. Find the set of values of x for which

$$\frac{x^3+5x-12}{x-3}>4.$$

(6)

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Question 3 continued

(Total 6 marks)

Q3

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4.

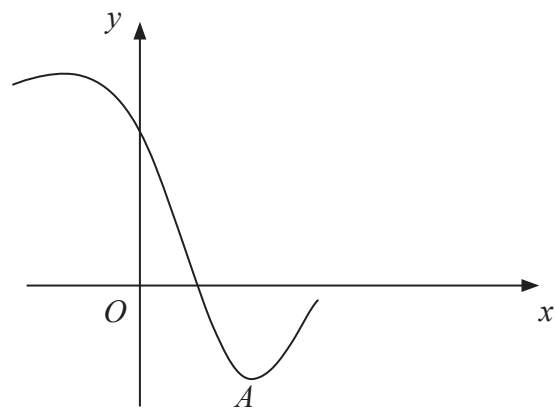

Figure 1

Figure 1 shows part of the curve with equation $y = f(x)$, where

$$f(x) = 1 - x - \sin(x^2).$$

The point A, with x-coordinate p, is a stationary point on the curve.

The equation $f(x) = 0$ has a root α in the interval $0.6 < \alpha < 0.7$.

(a) Explain why $x_0 = p$ is not suitable to use as a first approximation to α when applying the Newton-Raphson procedure to $f(x)$.

(1)

(b) Using $x_0 = 0.6$ as a first approximation to α, apply the Newton-Raphson procedure once to $f(x)$ to find a second approximation to α, giving your answer to 3 decimal places.

(5)

(c) By considering the change of sign of $f(x)$ over an appropriate interval, show that your answer to part (b) is accurate to 3 decimal places.

(2)

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Question 4 continued

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Question 4 continued

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Question 4 continued

Q4

(Total 8 marks)

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5. Given that $z_1 = 3 + 2\mathrm{i}$ and $z_2 = \dfrac{12 - 5\mathrm{i}}{z_1}$,

(a) find z_2 in the form $a + \mathrm{i}b$, where a and b are real.

(2)

(b) Show, on an Argand diagram, the point P representing z_1 and the point Q representing z_2.

(2)

(c) Given that O is the origin, show that $\angle POQ = \dfrac{\pi}{2}$.

(2)

The circle passing through the points O, P and Q has centre C. Find

(d) the complex number represented by C,

(2)

(e) the exact value of the radius of the circle.

(2)

Question 5 continued

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Question 5 continued

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Question 5 continued

(Total 10 marks)

Q5

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6. The curve C_1 has polar equation $r = 6\sin\theta$.

(a) Find a cartesian equation of C_1.

(2)

The curve C_2 has polar equation $r = (9\sqrt{6})\cos 2\theta$, $0 \leqslant \theta \leqslant \frac{\pi}{4}$.

(b) Express the polar equation of C_2 in terms of $\sin\theta$ only.

(1)

The tangent to C_2 at the point P is parallel to the initial line.

(c) Use differentiation to show that, at P, $\sin\theta = \frac{1}{\sqrt{6}}$.

(4)

(d) Find the value of r at P.

(2)

(e) Hence, or otherwise, show that C_1 and C_2 have a common tangent parallel to the initial line.

(3)

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

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Question 6 continued

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Question 6 continued

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Question 6 continued

(Total 12 marks)

Q6

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7.

$$\frac{d^2y}{dx^2} + 4\frac{dy}{dx} - 5y = 4e^x.$$

(a) Show that $\lambda x e^x$ is a particular integral of the differential equation, where λ is a constant to be found.

(4)

(b) Find the general solution of the differential equation.

(4)

(c) Find the particular solution for which $y = -\frac{2}{3}$ and $\frac{dy}{dx} = -\frac{4}{3}$ at $x = 0$.

(5)

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Question 7 continued

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Question 7 continued

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Question 7 continued

(Total 13 marks)

Q7

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8. (a) Show that the substitution $y = \frac{1}{t}$ transforms the differential equation

$$\sin x \frac{\mathrm{d}y}{\mathrm{d}x} + y \cos x = y^2, \quad 0 < x < \pi \qquad \text{(I)}$$

into the differential equation

$$\frac{\mathrm{d}t}{\mathrm{d}x} - t \cot x = -\operatorname{cosec} x, \quad 0 < x < \pi. \qquad \text{(II)}$$

(4)

(b) Solve the differential equation (II).

(5)

(c) Hence show that

$$y = \frac{1}{\cos x + c \sin x},$$

where c is an arbitrary constant, is a general solution of the differential equation (I).

(2)

Given that $y = \frac{\sqrt{2}}{3}$ at $x = \frac{\pi}{4}$,

(d) find the value of y at $x = \frac{\pi}{2}$.

(3)

N 3 0 0 2 4 A 0 2 4 2 8

Question 8 continued

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Question 8 continued

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Question 8 continued

Question 8 continued

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Q8

(Total 14 marks)

TOTAL FOR PAPER: 75 MARKS

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