Paper Reference(s)

6667/01

Edexcel GCE

Further Pure Mathematics FP1

Advanced Subsidiary

Practice Paper A

Time: 1 hour 30 minutes

Materials required for examination
Mathematical Formulae

Items included with question papers
Answer Booklet

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 formulas stored in them.

Instructions to Candidates

In the boxes on the answer book, write your centre number, candidate number, your surname, initials and signature.
Check that you have the correct question paper.
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 9 questions in this question paper. The total mark for this paper is 75.
There are 8 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.

$$\mathbf{A} = \begin{pmatrix} 2 & -1 \\ 4 & 3 \end{pmatrix}, \quad \mathbf{B} = \begin{pmatrix} 3 & 1 \\ -4 & 2 \end{pmatrix}, \quad \mathbf{I} = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}.$$

(a) Show that $\mathbf{AB} = c\mathbf{I}$, stating the value of the constant c.

(2)

(b) Hence, or otherwise, find $\mathbf{A}^{-1}$.

(2)

(Total 4 marks)

2.

$$f(x) = 5 - 2x + 3^{-x}$$

The equation $f(x) = 0$ has a root, α, between 2 and 3.

Starting with the interval (2, 3), use interval bisection twice to find an interval of width 0.25 which contains α.

(Total 4 marks)

3.

$$f(n) = (2n + 1)7^n - 1.$$

(a) Show that $f(k + 1) - f(k) = (ak + b)7^k$, stating the values of the constants a and b.

(3)

(b) Use induction to prove that, for all positive integers n, $f(n)$ is divisible by 4.

(4)

(Total 7 marks)

4.

$$f(x) = x^3 + x - 3.$$

(a) Use differentiation to find $f'(x)$.

(2)

The equation $f(x) = 0$ has a root, α, between 1 and 2.

(b) Taking 1.2 as your first approximation to α, apply the Newton-Raphson procedure once to $f(x)$ to obtain a second approximation to α. Give your answer to 3 significant figures.

(4)

(Total 6 marks)

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5. Given that $3 + i$ is a root of the equation $f(x) = 0$, where

$$f(x) = 2x^3 + ax^2 + bx - 10, \qquad a, b \in \mathbb{R},$$

(a) find the other two roots of the equation $f(x) = 0$,

(5)

(b) find the value of a and the value of b.

(3)

(Total 8 marks)

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6. (a) Write down the 2×2 matrix which represents an enlargement with centre $(0, 0)$ and scale factor k.

(1)

(b) Write down the 2×2 matrix which represents a rotation about $(0, 0)$ through $-90°$.

(2)

(c) Find the 2×2 matrix which represents a rotation about $(0, 0)$ through $-90°$ followed by an enlargement with centre $(0, 0)$ and scale factor 3.

(2)

The point A has coordinates $(a + 2, b)$ and the point B has coordinates $(5a + 2, 2 - b)$. A is transformed onto B by a rotation about $(0, 0)$ through $-90°$ followed by an enlargement with centre $(0, 0)$ and scale factor 3.

(d) Find the values of a and b.

(5)

(Total 10 marks)

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7. Given that $z = 1 + \sqrt{3}i$ and that $\frac{w}{z} = 2 + 2i$, find

(a) w in the form $a + ib$, where $a, b \in \mathbb{R}$,

(3)

(b) the argument of w,

(2)

(c) the exact value for the modulus of w.

(2)

On an Argand diagram, the point A represents z and the point B represents w.

(d) Draw the Argand diagram, showing the points A and B.

(2)

(e) Find the distance AB, giving your answer as a simplified surd.

(2)

(Total 11 marks)

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8. The parabola C has equation $y^2 = 4ax$, where a is a constant.

The point $(3t^2, 6t)$ is a general point on C.

(a) Find the value of a.

(1)

(b) Show that an equation for the tangent to C at the point $(3t^2, 6t)$ is

$$ty = x + 3t^2.$$

(4)

The point Q has coordinates $(3q^2, 6q)$.
The tangent to C at the point Q crosses the x-axis at the point R.

(c) Find, in terms of q, the coordinates of R.

(3)

The directrix of C crosses the x-axis at the point D.

Given that the distance $RD = 12$ and $q > 1$,

(d) find the exact value of q.

(4)

(Total 12 marks)

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9. (a) Prove by induction that, for all positive integers n,

$$\sum_{r=1}^{n} r^2 = \frac{1}{6}n(n+1)(2n+1).$$

(6)

(b) Show that $\sum_{r=1}^{n} (r+1)(r+5) = \frac{1}{6}n(n+7)(2n+7).$

(5)

(c) Hence calculate the value of $\sum_{r=10}^{40} (r+1)(r+5)$.

(2)

(Total 13 marks)

TOTAL FOR PAPER: 75 MARKS

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