Paper Reference(s)

6667/01

Edexcel GCE

Further Pure Mathematics FP1

Advanced Subsidiary

Practice Paper B

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 8 questions in this question paper. The total mark for this paper is 75.
There are 4 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.

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

where q is a real constant.

(a) Find det **A** in terms of q.

(2)

(b) Show that **A** is non-singular for all values of q.

(3)

(Total 5 marks)

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2. Given that $z = 22 + 4\text{i}$ and $\frac{z}{w} = 6 - 8\text{i}$, find

(a) $\left|\frac{z}{w}\right|$,

(2)

(b) w in the form $a + b\text{i}$, where a and b are real,

(3)

(c) the argument of z, in radians to 2 decimal places.

(2)

(Total 7 marks)

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

(5)

(b) Hence calculate the value of $\sum_{r=5}^{20}(r-1)(r+2)$.

(2)

(Total 7 marks)

4.

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

The root α of the equation f(x) = 0 lies in the interval [0.5, 0.6].

(a) Using the end points of this interval find, by linear interpolation, an approximation to α, giving your answer to 3 significant figures.

(4)

(b) Taking 0.55 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 significant figures.

(5)

(Total 9 marks)

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5. (a) Given that 2 + i is a root of the equation

$z^2 + bz + c = 0$, where b and c are real constants,

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

(ii) find the value of b and the value of c.

(5)

(b) Given that 2 + i is a root of the equation

$z^3 + mz^2 + nz - 5 = 0$, where m and n are real constants,

find the value of m and the value of n.

(5)

(Total 10 marks)

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6. **A**, **B** and **C** are non-singular 2 × 2 matrices such that

$$\mathbf{AB} = \mathbf{C}.$$

(a) Show that $\mathbf{B} = \mathbf{A}^{-1}\mathbf{C}$.

(2)

The triangle T_1 has vertices at the points with coordinates (0, 0), (5, 0) and (0, 3).

$$\mathbf{A} = \begin{pmatrix} -\frac{1}{\sqrt{2}} & -\frac{1}{\sqrt{2}} \\ \frac{1}{\sqrt{2}} & -\frac{1}{\sqrt{2}} \end{pmatrix}, \qquad \mathbf{C} = \begin{pmatrix} -1 & -1 \\ 1 & -1 \end{pmatrix}.$$

Triangle T_1 is mapped onto triangle T_2 by the transformation given by **C**.

(b) Find det **C**.

(1)

(c) Hence, or otherwise, find the area of triangle T_2.

(3)

Triangle T_1 is mapped onto triangle T_2 by the transformation given by **B** followed by the transformation given by **A**.

(d) Using part (a) or otherwise, find **B**.

(4)

(e) Describe fully the geometrical transformation represented by **B**.

(2)

(Total 12 marks)

7. (a) Show that the normal to the rectangular hyperbola $xy = 4$, at the general point $P\left(2t, \frac{2}{t}\right)$, $t \neq 0$ has equation

$$y = t^2x + \frac{2}{t} - 2t^3.$$

(5)

The normal to the hyperbola at the point A (–4, –1) meets the hyperbola again at the point B.

(b) Find the coordinates of B.

(7)

(Total 12 marks)

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8. (a) $\mathrm{f}(n) = n^3 - 10n + 15$.

Given that $\mathrm{f}(k + 1) - \mathrm{f}(k) = ak^2 + bk + c$,

(i) find the values of a, b and c.

(3)

(ii) Use induction to prove that, for all positive integers n, $\mathrm{f}(n)$ is divisible by 3.

(4)

(b) Prove by induction that, for $n \in \mathbb{Z}^+$, $\sum_{r=1}^{n} r2^r = 2\{1 + (n-1)2^n\}$.

(6)

(Total 13 marks)

TOTAL FOR PAPER: 75 MARKS

END