INSTRUCTIONS TO CANDIDATES

These instructions are the same on the Printed Answer Book and the Question Paper.

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the spaces provided on the Printed Answer Book.
- The questions are on the inserted Question Paper.
- Write your answer to each question in the space provided in the Printed Answer Book.
- Additional paper may be used if necessary but you must clearly show your Candidate Number, Centre Number and question number(s).
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer all the questions.
- Do not write in the bar codes.
- You are permitted to use a graphical calculator in this paper.
- Give non-exact numerical answers correct to 3 significant figures unless a different degree of accuracy is specified in the question or is clearly appropriate.

INFORMATION FOR CANDIDATES

This information is the same on the Printed Answer Book and the Question Paper.

- The number of marks is given in brackets [ ] at the end of each question or part question on the Question Paper.
- You are reminded of the need for clear presentation in your answers.
- The total number of marks for this paper is 72.
- The Printed Answer Book consists of 12 pages. The Question Paper consists of 4 pages. Any blank pages are indicated.

INSTRUCTION TO EXAMS OFFICER / INVIGILATOR

- Do not send this Question Paper for marking; it should be retained in the centre or destroyed.
The cubic polynomial $f(x)$ is defined by $f(x) = x^3 + ax^2 - ax - 14$, where $a$ is a constant.

(i) Given that $(x - 2)$ is a factor of $f(x)$, find the value of $a$. [3]

(ii) Using this value of $a$, find the remainder when $f(x)$ is divided by $(x + 1)$. [2]

Use the trapezium rule, with 3 strips each of width 3, to estimate the area of the region bounded by the curve $y = \sqrt{7} + x$, the $x$-axis, and the lines $x = 1$ and $x = 10$. Give your answer correct to 3 significant figures. [4]

(ii) Explain how the trapezium rule could be used to obtain a more accurate estimate of the area. [1]

Find and simplify the first four terms in the binomial expansion of $(1 + \frac{1}{2}x)^{10}$ in ascending powers of $x$. [4]

(ii) Hence find the coefficient of $x^3$ in the expansion of $(3 + 4x + 2x^2)(1 + \frac{1}{2}x)^{10}$. [3]

A sequence $u_1, u_2, u_3, \ldots$ is defined by $u_n = 5n + 1$.

(i) State the values of $u_1, u_2$ and $u_3$. [1]

(ii) Evaluate $\sum_{n=1}^{40} u_n$. [3]

Another sequence $w_1, w_2, w_3, \ldots$ is defined by $w_1 = 2$ and $w_{n+1} = 5w_n + 1$.

(iii) Find the value of $p$ such that $u_p = w_3$. [3]

The diagram shows two congruent triangles, $BCD$ and $BAE$, where $ABC$ is a straight line. In triangle $BCD$, $BD = 8$ cm, $CD = 11$ cm and angle $CBD = 65^\circ$. The points $E$ and $D$ are joined by an arc of a circle with centre $B$ and radius 8 cm.

(i) Find angle $BCD$. [2]

(ii) (a) Show that angle $EBD$ is 0.873 radians, correct to 3 significant figures. [2]

(b) Hence find the area of the shaded segment bounded by the chord $ED$ and the arc $ED$, giving your answer correct to 3 significant figures. [4]
6 (a) Use integration to find the exact area of the region enclosed by the curve \( y = x^2 + 4x \), the \( x \)-axis and the lines \( x = 3 \) and \( x = 5 \). [4]

(b) Find \( \int (2 - 6\sqrt{y}) \, dy \). [3]

(c) Evaluate \( \int_{1}^{\infty} \frac{8}{x^3} \, dx \). [4]

7 (i) Show that \( \frac{\sin^2 x - \cos^2 x}{1 - \sin^2 x} \equiv \tan^2 x - 1 \). [2]

(ii) Hence solve the equation
\[
\frac{\sin^2 x - \cos^2 x}{1 - \sin^2 x} = 5 - \tan x,
\]
for \( 0^\circ \leq x \leq 360^\circ \). [6]

8 (a) Use logarithms to solve the equation \( 5^{3w-1} = 4^{250} \), giving the value of \( w \) correct to 3 significant figures. [5]

(b) Given that \( \log x (5y + 1) - \log x 3 = 4 \), express \( y \) in terms of \( x \). [4]

9 A geometric progression has first term \( a \) and common ratio \( r \), and the terms are all different. The first, second and fourth terms of the geometric progression form the first three terms of an arithmetic progression.

(i) Show that \( r^3 - 2r + 1 = 0 \). [3]

(ii) Given that the geometric progression converges, find the exact value of \( r \). [5]

(iii) Given also that the sum to infinity of this geometric progression is \( 3 + \sqrt{5} \), find the value of the integer \( a \). [4]
Thursday 27 May 2010
Morning
Duration: 1 hour 30 minutes

Candidates answer on this Printed Answer Book

OCR Supplied Materials:
• Question Paper 4722 (inserted)
• List of Formulae (MF1)

Other Materials Required:
• Scientific or graphical calculator

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