Predictive IB Mathematics Analysis and Approaches HL Paper 1

May 2025

2 hours

Instructions to candidates

- You are not permitted access to any calculator for this paper.

- Answer all questions.

- Section A: answers must be written within the answer boxes provided.

- Section B: answers must be written in the answer booklet provided.

- Unless otherwise stated in the question, all numerical answers should be given exactly or correct to three significant figures.

- A clean copy of the mathematics: analysis and approaches HL formula booklet is required for this paper.

- The maximum mark for this examination paper is [110 marks].

Section A

Answer all questions. Answers must be written within the answer boxes provided. Working may be continued below the lines, if necessary. In this section, full marks are not necessarily awarded for a correct answer with no working.

1. [Maximum mark: 0]

The function f is defined by $f(x) = \frac{2x-3}{x+1}$, for $x \in \mathbb{R}$, $x \neq -1$.

(a) Find $f^{-1}(x)$. 3

(b) Solve the inequality $|f(x)| < 1$. 3

2. [Maximum mark: 0]

Consider the complex number $z = \frac{(1+i\sqrt{3})^4}{(1-i)^3}$. Find $|z|$ and $\arg(z)$.

3. [Maximum mark: 0]

Solve the differential equation $\frac{dy}{dx} = \frac{y^2+1}{x^2+1}$, given that $y = 0$ when $x = 1$. Give your answer in the form $y = f(x)$.

4. [Maximum mark: 0]

A function is defined by $f(x) = e^{2x} \sin x$. Find the Maclaurin series for $f(x)$ up to and including the term in x^3.

5. [Maximum mark: 0]

The sum of the first n terms of an arithmetic sequence is given by $S_n = n^2 + 4n$.

(a) Find the first term u_1 and the common difference d. 3

(b) Find an expression for the n-th term u_n. 2

6. [Maximum mark: 0]

Prove by mathematical induction that for $n \in \mathbb{Z}^+$, $\sum_{r=1}^{n} r(r+2) = \frac{n(n+1)(2n+7)}{6}$.

7. [Maximum mark: 0]

Consider the function $f(x) = \ln(x^2 - 4x + 5)$.

(a) Find the coordinates of the stationary point of the graph of $y = f(x)$. 4

(b) Determine the nature of this stationary point. 2