IB Demystified

EXAMINERS MODERATORS MENTORS

Mathematics: Analysis and Approaches
Standard Level

Paper 1 – Mock Examination

Mock Exam 1

Question Paper

Non-calculator

Time allowed: 1 hour 30 minutes

Maximum mark: **80 marks**

Mathematics: Analysis and Approaches SL – Paper 1 (Non-calculator)

Instructions to Candidates

- Do not open this examination paper until you are told to do so.
- **A calculator is not permitted** for this paper.
- A clean copy of the *Mathematics: Analysis and Approaches SL formula booklet* may be used.
- Answer **all** questions.
- **Section A:** write your answers in the answer boxes provided. Working may be continued below the lines if required.
- **Section B:** write your answers in the answer booklet or on the continuation pages provided. **Start each question on a new page.**
- Unless a question states otherwise, give numerical answers exactly or correct to three significant figures.
- Exact answers are preferred wherever possible.
- Show all working. Full marks may not be awarded for a correct answer that is not supported by working.
- The maximum mark for this paper is **80 marks**.
- The time allowed is **1 hour 30 minutes**.

Candidate name: .....

Session number: .....

Date: .....

A clean copy of the formula booklet is required for this paper.

Section A

Full marks are not necessarily awarded for a correct answer with no working. Where an answer is incorrect, some marks may be awarded for correct method, provided this is shown by written working. You are advised to show all working.

Answer all questions in the answer boxes provided.

1. **[Maximum mark: 5]**

Write each of the following expressions in the form $\log_2 k$, where $k \in \mathbb{Q}^+$.

(a) $\log_2 5 + \log_2 6$ [1]

(b) $2\log_2 3 - \log_2 6$ [2]

(c) $3 + \log_2 5$ [2]

2. **[Maximum mark: 5]**

Consider the function $f(x) = 2x^3 - 9x^2 + 12x + 1$, where $x \in \mathbb{R}$.

The graph of $y = f(x)$ has a local maximum point.

Find the coordinates of the local maximum point.

3. **[Maximum mark: 7]**

The quadratic equation $x^2 + (k+2)x + (k+5) = 0$, where $k > 0$, has two equal real roots.

(a) Show that $k^2 - 16 = 0$. [3]

(b) Hence find the value of k. [2]

(c) For this value of k, find the repeated root of the equation. [2]

4. **[Maximum mark: 4]**

An arithmetic sequence has third term 7 and eighth term 22.

(a) Find the common difference and the first term. [2]

(b) Find the sum of the first 20 terms. [2]

5. **[Maximum mark: 6]**

Events A and B are such that

$$P(A) = \frac{1}{2}, \qquad P(B) = \frac{2}{5}, \qquad P(A \cup B) = \frac{7}{10}.$$

(a) Find $P(A \cap B)$. [2]

(b) Find $P(A \mid B)$. [2]

(c) Determine whether A and B are independent, justifying your answer. [2]

6. **[Maximum mark: 8]**

A geometric sequence has first term a and common ratio r, where $0 < r < 1$. The second term of the sequence is 12 and the fourth term is 3.

(a) Show that $r = \frac{1}{2}$, and find the value of a. [4]

(b) Find the sum to infinity of the sequence. [2]

(c) Find the least value of n for which the sum of the first n terms exceeds 47. [2]

Section B

Answer all questions in the answer booklet or on the continuation pages provided. Start each question on a new page.

Full marks are not necessarily awarded for a correct answer with no working. Where an answer is incorrect, some marks may be awarded for correct method, provided this is shown by written working. You are advised to show all working.

7. **[Maximum mark: 13]**

Consider the function $f(x) = x^3 - 3x^2 - 9x + 5$, where $x \in \mathbb{R}$.

(a) Find $f'(x)$. [2]

(b) Find the coordinates of the two stationary points of the graph of $y = f(x)$, and determine the nature of each. [6]

(c) Find the equation of the normal to the graph of $y = f(x)$ at the point where $x = 1$, giving your answer in the form $y = mx + c$. [5]

8. **[Maximum mark: 15]**

The function f is defined by $f(x) = x^2 - 6x + 13$, for $x \geq 3$.

(a) Express $f(x)$ in the form $(x-h)^2 + k$. [2]

(b) State the range of f. [2]

(c) Find an expression for $f^{-1}(x)$, and state its domain. [5]

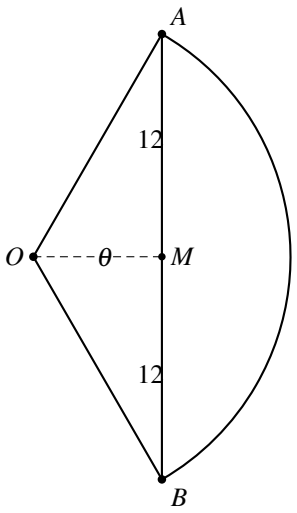
The function g is defined by $g(x) = 2x - 1$, for $x \in \mathbb{R}$.

(d) Find an expression for $(f \circ g)(x)$, and hence solve the equation $(f \circ g)(x) = 13$. [6]

9. **[Maximum mark: 17]**

The following diagram shows a sector OAB of a circle with centre O and radius 12 *cm. The angle* $A\hat{O}B = \theta$ *radians. The point M is the midpoint of the chord* $[AB]$.

diagram not to scale



The perimeter of the sector OAB is $(24 + 8\pi)$ cm.

(a) Show that $\theta = \dfrac{2\pi}{3}$. [3]

(b) Find the exact area of the sector OAB. [2]

(c) Find the exact area of triangle OAB. [3]

(d) Hence find the exact area of the minor segment bounded by the chord $[AB]$ and the minor arc AB. [2]

(e) Show that the length of the chord $[AB]$ is $12\sqrt{3}$ cm. [3]

(f) Find the exact length of $[OM]$, the distance from the centre O to the chord $[AB]$. [4]

Section B — Answer Booklet / Continuation Pages

Start each question on a new page. Write the question number clearly.

Question _____

Question _____

Question _____

Question _____

Question _____