IB Demystified

EXAMINERS MODERATORS MENTORS

Mathematics: Analysis and Approaches
Standard Level

Paper 1 – Mock Examination

Mock Exam 2

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]**

Solve each of the following equations for x, giving your answers exactly.

(a) $3^{2x-1} = 27$ [2]

(b) $\ln x + \ln(x-3) = \ln 4$ [3]

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

Find the exact value of

$$\int_1^2 \left(6x^2 - \frac{4}{x^2}\right) dx.$$

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

Consider the equation $2\cos^2 x - 3\sin x = 0$.

(a) Show that this equation can be written as $2\sin^2 x + 3\sin x - 2 = 0$. [2]

(b) Hence solve $2\cos^2 x - 3\sin x = 0$ for $0 \leq x \leq 2\pi$. [5]

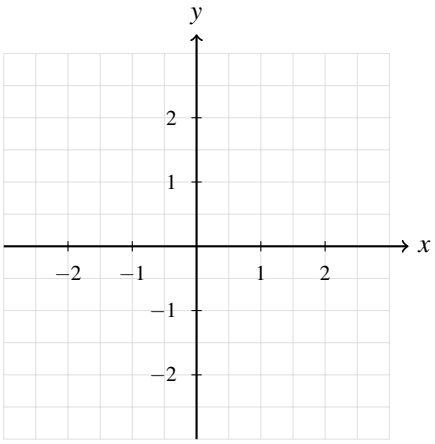
4. **[Maximum mark: 4]**

The function f is defined by $f(x) = e^x - 2$, where $x \in \mathbb{R}$.

(a) Write down the equation of the horizontal asymptote of the graph of $y = f(x)$. [1]

(b) Find the exact coordinates of the point where the graph crosses the x-axis. [1]

(c) On the axes below, sketch the graph of $y = f(x)$, showing the horizontal asymptote and the coordinates where the graph crosses the axes. [2]



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

A and B are independent events with $\mathrm{P}(A) = \frac{3}{5}$ and $\mathrm{P}(B) = \frac{1}{2}$.

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

(b) Find $\mathrm{P}(A \cup B)$. [2]

(c) Find $\mathrm{P}(A \mid B')$. [2]

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

The curve $y = 4x - x^2$ and the line $y = x$ are drawn on the same axes.

(a) Find the coordinates of the points where the curve and the line intersect. [3]

(b) Find the exact area of the region enclosed by the curve and the line. [5]

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]**

A particle moves in a straight line. Its velocity, $v\,\text{m s}^{-1}$, at time t seconds is given by

$$v(t) = 3t^2 - 12t + 9, \qquad 0 \leq t \leq 5.$$

(a) Find the times at which the particle is instantaneously at rest. [3]

(b) Find the acceleration of the particle when $t = 2$. [2]

(c) Find the displacement of the particle from its starting position when $t = 3$. [3]

(d) Find the total distance travelled by the particle during the first 3 seconds. [5]

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

Part A The function f is defined by $f(x) = \ln(2x-4)$, for $x > 2$.

(a) Write down the equation of the vertical asymptote of the graph of $y = f(x)$. [1]

(b) Find the exact coordinates of the point where the graph crosses the x-axis. [2]

(c) Find an expression for $f^{-1}(x)$, and state its domain. [4]

Part B Solve the following equations, giving your answers exactly.

(d) $e^{2x} - 7e^x + 12 = 0$ [4]

(e) $\log_2 x + \log_2(x-2) = 3$ [4]

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

The depth of water, d metres, in a harbour at time t hours after midday is modelled by

$$d(t) = 5 + 3\cos\left(\frac{\pi}{6}t\right), \qquad 0 \leq t \leq 24.$$

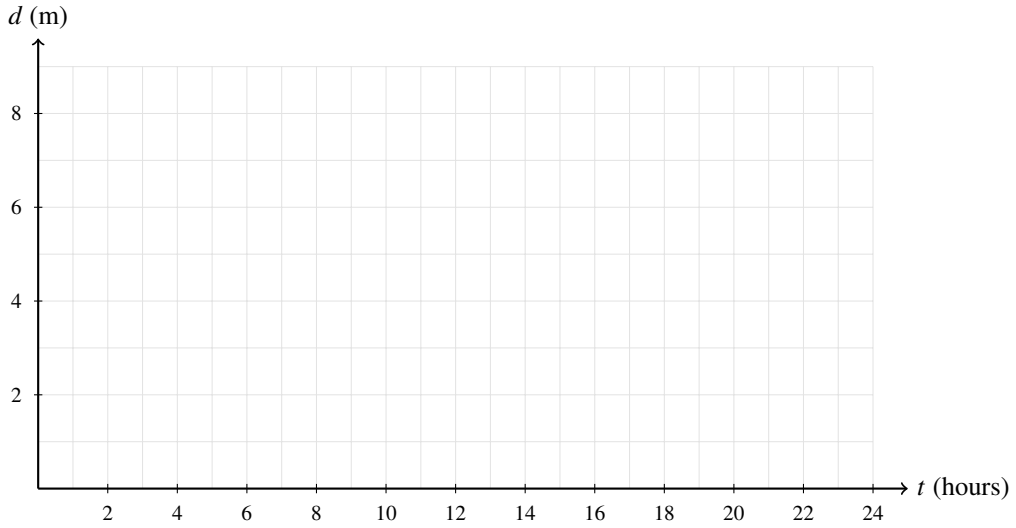
(a) Find the depth of water at $t = 0$. [1]

(b) Write down the maximum and minimum depths of water. [2]

(c) Find the period of the model, and interpret it in this context. [2]

(d) Find the first two times, for $t \geq 0$, at which the depth of water is exactly 6.5 metres. [5]

(e) On the axes below, sketch the graph of d against t for $0 \leq t \leq 24$, showing the maximum and minimum depths and the depth at $t = 0$. [4]



(f) Find the total length of time, during the interval $0 \leq t \leq 12$, for which the depth of water is at least 6.5 metres. [3]

Section B — Answer Booklet / Continuation Pages

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

Question _____

Question _____

Question _____

Question _____

Question _____