



IB Demystified

Mathematics: Analysis and Approaches Higher Level

Paper 2 — Mock Examination

Mock Exam 1

Graphic display calculator required

Time allowed: 2 hours

Maximum mark: 110

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Information for candidates

- Do not begin this paper until you are told that you may do so.
- A graphic display calculator is needed throughout this examination.
- You may use a clean copy of the *Mathematics: Analysis and Approaches HL formula booklet*.
- Answer every question.
- Section A answers must be written in the working space provided beneath each question.
- Section B answers must be written on the continuation pages, beginning each question on a fresh page.
- Give numerical answers exactly, or rounded to three significant figures, unless a question instructs otherwise.
- Any answer obtained from a calculator must be backed up by suitable written working; full marks are not guaranteed for an unsupported result.
- When a graph is used to solve a problem, include a sketch or a clear description of the graphing approach.
- When you rely on regression, equation solving, numerical integration, a normal or binomial model, or a graph intersection, the method must be shown clearly.
- The maximum mark for this paper is **110**. The time allowed is **2 hours**.

Candidate information

Candidate name: _____

Session number: _____

Date: _____

9.

[Maximum mark: 7]

Two lines are defined by

$$L_1 : \mathbf{r} = \begin{pmatrix} 1 \\ 0 \\ 2 \end{pmatrix} + s \begin{pmatrix} 1 \\ 2 \\ -1 \end{pmatrix}, \quad L_2 : \mathbf{r} = \begin{pmatrix} 1 \\ k \\ -1 \end{pmatrix} + t \begin{pmatrix} 2 \\ -1 \\ 1 \end{pmatrix},$$

where k is a constant and $s, t \in \mathbb{R}$. The lines intersect.

(a) Find the value of k and the coordinates of the point of intersection. [4]

(b) Find the acute angle between L_1 and L_2 . [3]

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Begin each question on a new page of the answer booklet.

10. [Maximum mark: 16]

A drug is administered to a patient. The concentration C , in mg L^{-1} , of the drug in the bloodstream t hours after the dose is modelled by

$$C(t) = 18te^{-0.6t}, \quad t \geq 0.$$

- (a) Find the concentration of the drug 3 hours after the dose. [2]
- (b) Find the maximum concentration of the drug and the time at which it occurs. [4]
- (c) The drug is effective only while $C(t) \geq 4$. Find the length of time, in hours, for which the drug is effective. [4]
- (d) Find the average concentration of the drug during the first 8 hours. [3]
- (e) Find the rate at which the concentration is changing when $t = 6$, and interpret your answer. [3]

11. [Maximum mark: 18]

The points $A(2, -1, 3)$, $B(5, 1, 4)$ and $C(3, 4, 1)$ are given.

- (a) Find \overrightarrow{AB} and \overrightarrow{AC} . [2]
- (b) Find $\overrightarrow{AB} \times \overrightarrow{AC}$ and hence the area of triangle ABC . [4]
- (c) Find the Cartesian equation of the plane Π that contains A , B and C . [4]
- (d) The line L has equation $\mathbf{r} = \begin{pmatrix} 1 \\ 0 \\ 0 \end{pmatrix} + \lambda \begin{pmatrix} 2 \\ 1 \\ -1 \end{pmatrix}$. Find the acute angle between L and the plane Π . [4]
- (e) Find the shortest distance from the point $D(6, -2, 5)$ to the plane Π . [4]

12. [Maximum mark: 18]

A machine fills cups with coffee. The volume of coffee in a cup, X millilitres, is normally distributed. It is known that 10% of cups contain less than 230 mL and that 15% of cups contain more than 260 mL.

- (a) Find the mean μ and standard deviation σ of X . [5]
- (b) Find $P(240 < X < 255)$. [2]
- (c) A cup is described as *underfilled* if it contains less than 235 mL. Find the probability that a randomly chosen cup is underfilled. [2]
- (d) Eight cups are chosen at random. Find the probability that exactly two of them are underfilled. [3]
- (e) Find the probability that at least one of the eight cups is underfilled. [2]
- (f) Given that a cup is underfilled, find the probability that it contains less than 225 mL. [4]

End of examination