International School Lausanne

ISL DOCUMENT

ANALYSIS AND APPROACHES VS APPLICATIONS AND INTERPRETATION: ADVICE FOR STUDENTS IN CHOOSING

Effective: 01 February 2024
Owner: Assistant Principal - IB Diploma Programme Coordinator

Table of content

Two mathematics courses are now available in the IB Diploma:

Analysis and approaches	**(A&A)**	at standard level (SL)	and higher level (HL)
Applications and interpretation	**(A&I)**	at standard level (SL)	and higher level (HL)

What is the difference between the courses?

The A&A and A&I courses share the same syllabus outline below and are connected by the same mathematical body of knowledge, ways of thinking and approaches to problems.

Topic 1—Number and algebra

Topic 2—Functions

Topic 3—Geometry and trigonometry SL ~ 120 hours

Topic 4—Statistics and probability HL ~ 240 hours

Topic 5—Calculus

Topic 6—Mathematical exploration

However, the two courses approach mathematics from different perspectives; as a discipline that is studied for its intrinsic pleasure and as a means to explore and understand the world we live in. The differences in the courses are also related to the types of tools, for instance technology, that are used to solve abstract or practical problems. The SL content is a complete subset of the HL content in both courses.

The nature of analysis and approaches (A&A)

This course recognizes the need for analytical expertise in a world where innovation is increasingly dependent on a deep understanding of mathematics. This course includes topics that are both traditionally part of a pre-university mathematics course (for example, functions, trigonometry, calculus) as well as topics that are amenable to investigation, conjecture and proof, for instance the study of sequences and series at both SL and HL, and proof by induction at HL.

The course allows the use of technology, as fluency in relevant mathematical software and hand-held technology is important regardless of choice of course. However, this course has a strong emphasis on the ability to construct, communicate and justify correct mathematical arguments.

The nature of applications and interpretation (A&I)

This course recognizes the increasing role that mathematics and technology play in a diverse range of fields in a data-rich world. As such, it emphasizes the meaning of mathematics in context by focusing on topics that are often used as applications or in mathematical modelling. To give this understanding a firm base, this course also includes topics that are traditionally part of a pre-university mathematics course such as calculus and statistics.

The course makes extensive use of technology to allow students to explore and construct mathematical models. The course develops mathematical thinking, often in the context of a practical problem and using technology to justify conjectures.

Which course should I choose?

Every student has different needs, aspirations, interests and abilities. Great care should be taken to select the course and level that is most appropriate for you.

When choosing a course you need to take into account:

- your abilities in mathematics and the type of mathematics in which you can be successful
- the subjects you wish to study in the future
- the advice of your mathematics teacher, who recognises your particular strengths.

Above all, you should ask yourself how much the nature of each course appeals to you. This is an active decision that each student will need to make.

Who chooses analysis and approaches?

Students who choose mathematics: analysis and approaches at SL or HL should be comfortable in the manipulation of algebraic expressions, enjoy the recognition of patterns, and understand the mathematical generalization of these patterns. Students who wish to take this course at higher level will have strong algebraic skills and the ability to understand simple proof. This subject is aimed at students who will go on to study subjects with substantial mathematics content such as mathematics itself, engineering, physical sciences, or economics for example.

Who chooses applications and interpretation?

Students who choose mathematics: applications and interpretation at SL or HL should enjoy seeing mathematics used in real-world contexts to solve real-world problems. Students who wish to take this course at higher level will have good algebraic skills and experience of solving real-world problems. They will be students who get pleasure and satisfaction when exploring challenging problems and who are comfortable to undertake this exploration using technology. This subject is aimed at students who will go on to study subjects such as social sciences, natural sciences, statistics, business, design, psychology, and economics, for example.

Should I choose higher level or standard level?

To ensure accessibility we advise students only to consider higher level if they are consistently attaining at Level 6 or higher in extended mathematics or at Level 7 in standard mathematics.

What course will my university require?

The nature of the two courses and the types of student they are aimed at is outlined above. Every university has different expectations and entrance requirements relating to IBDP mathematics courses. Some university courses or countries will have restrictions on which mathematics course, level and final grade are acceptable.

Why do we not offer A&I at higher level at ISL?

Following their introduction in 2019, the nature and difficulty of the different courses is now understood. Though the A&A and A&I courses are very different in nature, the level of challenge at higher level in each course is very similar. We therefore see no advantage in offering an additional higher level option.

Some example questions

Though both courses share the same core topics, the approaches you will be expected to use on examinations will be different in nature:

An example from Year 11

Analysis and approaches

Question: Find the vertex of the quadratic function $f(x)=-2x^2+20x+600$

Solution: Completing the square $f(x)=-2(x^2-10x)+600$

$= -2((x-5)^2-25)+600$

$= -2(x-5)^2+650$

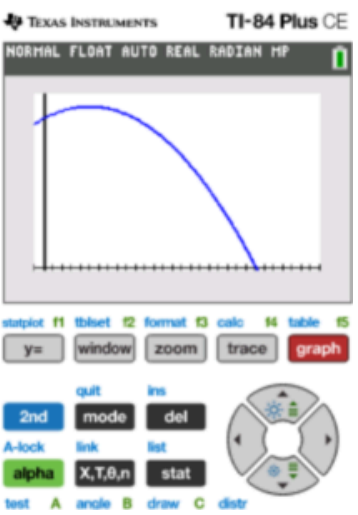
The function's vertex is at (5, 650)

Applications and interpretation

Question: The height in metres (m) of a ball thrown from the roof of a tall building can be modelled by the quadratic function
$f(x)=-2x^2+20x+600$, where x is the number of seconds (s) after the ball has been thrown.

Calculate

(a) The height of the building
(b) The maximum height reached by the ball
(c) The time taken for the ball to reach the ground



Solution: By graphing the function, we can see trajectory of the ball.

(a) When x = 0, f(x) = 600
The building is 600m tall.

(b) Vertex is at (5, 650)
Therefore, maximum height is 650m

(c) The positive x-intercept is at x = 23.0277
To the nearest second it takes 23 seconds.

Both of these question types have been studied in Year 11. They both require and understanding of quadratic functions, but they are very different in their nature.

An example from the IB Diploma

These two questions are taken from specimen standard level examination papers from the new A&A and A&I mathematics courses. You are not necessarily expected to understand the mathematics here just yet!

Both require an understanding of logarithmic functions. However, the A&A question focuses on constructing a correct mathematical argument, whereas in the A&I question, mathematics is used to solve a problem in a real world context.

Analysis and approaches

[Maximum mark: 8]

(a) Show that $\log_9(\cos 2x + 2) = \log_3\sqrt{\cos 2x + 2}$. [3]

(b) Hence or otherwise solve $\log_3(2\sin x) = \log_9(\cos 2x + 2)$ for $0 < x < \frac{\pi}{2}$. [5]

Applications and interpretation

[Maximum mark: 4]

The intensity level of sound, L measured in decibels (dB), is a function of the sound intensity, S watts per square metre ($\mathrm{W\,m^{-2}}$). The intensity level is given by the following formula.

$$L = 10\log_{10}(S \times 10^{12}),\ S \geq 0$$

(a) An orchestra has a sound intensity of $6.4 \times 10^{3}\,\mathrm{W\,m^{-2}}$. Calculate the intensity level, L of an orchestra. [2]

(b) A rock concert has an intensity level of $112\,\mathrm{dB}$. Find the sound intensity, S. [2]