School-supervised mathematical exploration

International Baccalaureate · IB Diploma · Mathematics: Applications and Interpretation · HL

Scope and prerequisites

This handout covers selected HL topics for the course first assessed in 2021; it is not the whole syllabus.

Prerequisites: read the stated quantities and units, and use arithmetic and the model conditions below.

The examples are original and fictional: they are not real measurements or real student investigations.

Planning a mathematical exploration

What makes an investigation mathematical?

- A student wants to predict queue waiting time at the school canteen. A useful exploration needs a question, data and mathematics the student can explain.
- This lesson studies **assumption** : A condition adopted to make a mathematical model possible and whose effect should be evaluated.

The method

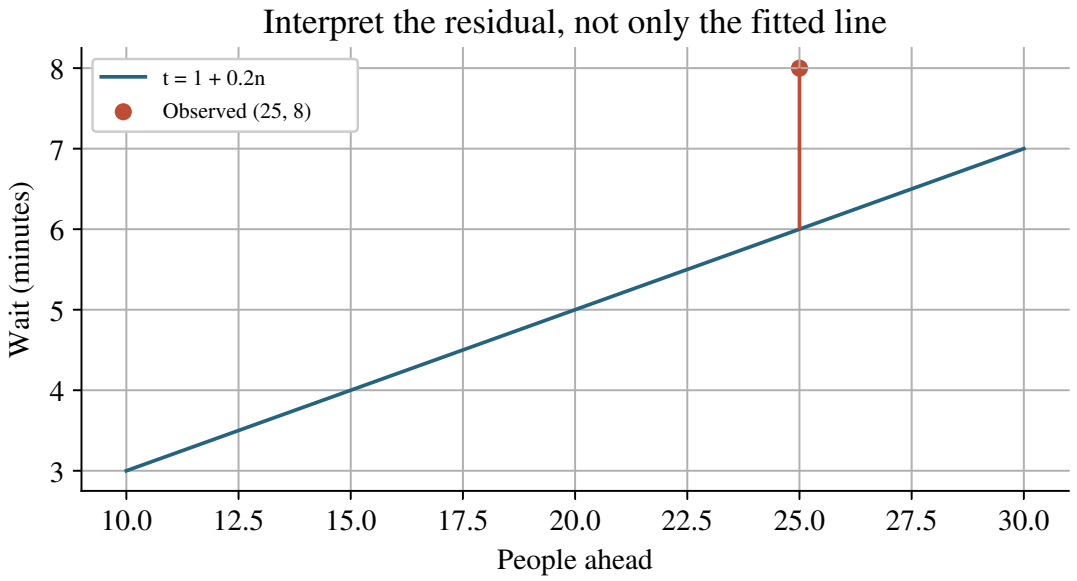
- Frame a focused question with measurable variables and a feasible method.
- Keep a dated record of decisions, sources and mathematical reasoning.
- Use technology to support analysis, and explain every important output in your own words.

A worked case

$$\widehat{t} = 1 + 0.2n, \qquad e = t - \widehat{t}$$

Example:

A pilot records mean waiting times of 3,5,7 minutes when 10,20,30 people are ahead. A first model is t=1+0.2n. At n=25 it predicts 6 minutes. An actual wait of 8 gives residual 2; investigate varying service rates rather than hiding the mismatch.



At $n = 25$ the model predicts 6 minutes but 8 was observed: residual 2

Where it goes wrong

- Do not copy a sample exploration, invent data or manufacture personal engagement.
- A prediction is not evidence until it is compared with observations.
- Consent and privacy matter when collecting school data.

Not true: The school-supervised mathematical exploration can be replaced by a timed written mock exam. The exploration is an extended piece of written work assessed on its own criteria; a timed exam tests something different.

Applying it

- The school supervises topic approval, checkpoints, authenticity and assessment.
- For the current 2021 course use the current school's guide and criteria; the 2029 inquiry criteria belong to a different assessment version.

In your course

- Applications and Interpretation HL, the course first assessed in 2021.
- Every paper allows a calculator, but method marks still need the expression or equation written before its value.

Key:

- **Assumption**: A condition adopted to make a mathematical model possible and whose effect should be evaluated.
- Frame a focused question with measurable variables and a feasible method.
- Watch for: do not copy a sample exploration, invent data or manufacture personal engagement.

Write from a predicted wait of 10

- The model $t = 6 + 0.5n$ predicts the wait at $n = 8$.
- An observed wait of 16 leaves a residual. A timed mock does not replace the exploration.

Write from a zero residual

- At $n = 5$ the observed wait equals the model's prediction exactly.
- What is the residual, and does it certify the model? Zero – one perfect point certifies nothing; the PATTERN of all residuals does.

Write from a proportionality check

- When n doubles from 10 to 20, the observed wait doubles from 5 to 10.
- Which fits, linear or proportional? Proportional – wait = 0.5 n, a line through the origin; plot before trusting any trend.