

6.1 Planning a mathematical exploration

Name: _____ Class: _____ Date: _____

Total: 13 marks

KEY WORDS assumption

Objective

Planning a mathematical exploration. Supported HL concept preparation; original classroom practice, not an official IB paper or assessed learner work.

1 Key knowledge and worked examples

■ 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.

■ Choose the mathematical structure

- 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.
- State the allowed inputs and units before calculating. An equation should express the relationship, not just record a calculator entry.

■ Work through a checked case

$$\hat{t} = 1 + 0.2n, \quad e = t - \hat{t}$$

- Check the result against the starting quantities. Substitute into the original relation, or compare the graph and numerical answer where appropriate.

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.



■ Test a tempting shortcut

- 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.
- When a shortcut fails, identify the assumption it breaks. Keep an exact value until the requested final rounding.

Warn:

The school-supervised mathematical exploration can be replaced by a timed written mock exam. This claim is false. Explain which definition or assumption it violates.

■ Interpret a new situation

- 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.
- A complete solution gives the mathematical result and explains what it means. Check that it is possible in the stated context.

■ Use this in your course

- Current first-assessment-2021 Analysis and Approaches HL. This is authored concept support; the full guide is needed to certify every objective.
- Give the method before the final answer, and use the paper's calculator and formula rules. Review a wrong answer by locating the first invalid step.

Key:

A condition adopted to make a mathematical model possible and whose effect should be evaluated. Choose the relationship, show the method, check its assumptions and interpret the result.

2 Practice

2.1 For $t=1+0.2n$, find predicted wait at $n=25$. Show the relation, substitution and units. [2]

2.2 Find the residual for observed 8 and predicted 6. Show the relation, substitution and units. [2]

2.3 Three independent measurements are 4,6,8. Find their mean. Show the relation, substitution and units. [2]

2.4 Decide whether this claim is true and justify: The school-supervised mathematical exploration can be replaced by a timed written mock exam. [2]

2.5 Which description correctly defines assumption? Choose one answer.

- **A** A condition adopted to make a mathematical model possible and whose effect should be evaluated.
- **B** A numerical answer that needs no assumptions or interpretation
- **C** A rule that remains valid even when its required conditions fail [1]

3 Exam-style questions

3.1 Fictional wait times for $n=10, 20, 30$ are 4, 7, 11 minutes. A proposed model is $t=1+0.3n$. Find residuals and propose a useful next investigation; do not write a learner's assessed exploration. [4]

Solutions

2.1 Use $n=25$ in the model: $1+0.2\times 25=6$ minutes.

2.2 Residual= $8-6=2$ minutes.

2.3 Mean= $(4+6+8)/3=6$.

2.4 False. 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.

2.5 A A condition adopted to make a mathematical model possible and whose effect should be evaluated.

3.1 Predictions 4, 7, 10; residuals 0, 0, 1 minute. Collect repeated observations across a wider justified range, inspect curvature/variation and compare models. One residual pattern from three invented values does not validate causality or certify an IB exploration.