

Exercise walk-through

# 6.1

## Planning a mathematical exploration

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International Baccalaureate · IB Diploma · Mathematics: Applications and Interpretation

# 6.1 Planning a mathematical exploration

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Name: \_\_\_\_\_ Class: \_\_\_\_\_ Date: \_\_\_\_\_

**Total: 13 marks**

**KEY WORDS** assumption

# Objective

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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

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### ■ 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.

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■ **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.

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■ **Work through a checked case**

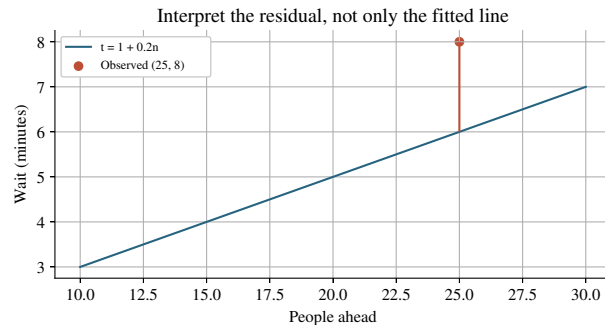
$$\hat{t} = 1 + 0.2n, \quad e = t - \hat{t}$$

- 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.

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■ **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.

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■ **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.
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## ■ Use this in your course

- Current first-assessment-2021 Applications and Interpretation 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.

## Exercises 2.1-2.3

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

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

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

## Exercises 2.1-2.3

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

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

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

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

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

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

## Exercises 2.4·2.5

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**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]

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**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]

## Exercises 2.4-2.5

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**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]

**2.4** 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.

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**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]

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

## Exercise 3.1

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

## Exercise 3.1

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

**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.