Queensland Curriculum and Assessment Authority

General Mathematics 2019 v1.2

IA1: Sample assessment instrument

Problem-solving and modelling task (20%)

This sample has been compiled by the QCAA to assist and support teachers in planning and developing assessment instruments for individual school settings.

Student name

Student number

Teacher

Issued

Due date

Marking summary

Criterion	Marks allocated	Provisional marks
Formulate	4	
Solve	7	
Evaluate and verify	5	
Communicate	4	
Overall	**20**	

Conditions

Technique	Problem-solving and modelling task
Unit	Unit 3: Bivariate data, sequences and change, and Earth geometry
Topic/s	Topic 1: Bivariate data analysis
Duration	4 weeks (including 3 hours of class time)
Mode/length	Written: Up to 10 pages (including tables, figures and diagrams) and a maximum of 2000 words
Individual/group	A unique response must be developed by each student
Other	Use of technology is required and must go beyond simple computation or word processing
Resources	The technology used can include scientific calculator, graphics calculator (CAS or non-CAS), spreadsheet program and/or other mathematical software

Context

The term ‘regression’ was first used in the late 1800s by Sir Francis Galton, who was interested in the study of biometrics (the application of statistical analysis to biological data). Galton’s law of ancestral heredity was concerned with comparing measurable characteristics of children and their parents.[1]

In 1903, Karl Pearson, assisted by Alice Lee, further investigated Galton’s findings and developed conclusions relating to the stature of fathers and their adult sons, and mothers and their adult daughters.[2]

While it could be simply argued that it is obvious from life experience that tall parents generally have tall children, the power of mathematics is that it can be used to quantify and test such relationships.

[1] Bulmer, M 2003, *Francis Galton: Pioneer of heredity and biometry*, JHU Press, Baltimore.

[2] Pearson, K and Lee, A 1903, ‘On the laws of inheritance in man: I. Inheritance of physical characteristics’, in *Biometrika*, vol. 2, no. 4, pp. 357–462, www.jstor.org/stable/2331507?seq=1#page_scan_tab_contents.

Task

Investigate the phenomenon of ancestral heredity by focusing on the height of a parent and their biological child of the same sex, using data from students at your school.

The investigation should explore the dependence of a male’s height on his father’s height, or the dependence of a female’s height on her mother’s height.

Can a person’s height be reliably predicted from their relative’s height?

To complete this task, you must:

- respond with a range of understanding and skills, such as using mathematical language, appropriate calculations, tables of data, graphs and diagrams
- provide a response to the context that highlights the real-life application of mathematics
- respond using a written report format that can be read and interpreted independently of the problem-solving and modelling task sheet
- develop a unique response
- use both analytic procedures and technology.

Checkpoints

☐ One week after issue date: Students email an assessment plan to the teacher with their individual data.

☐ Two weeks after issue date: Students email evidence of their progress to their teacher.

☐ Three weeks after issue date: Students email a draft report to their teacher for feedback.

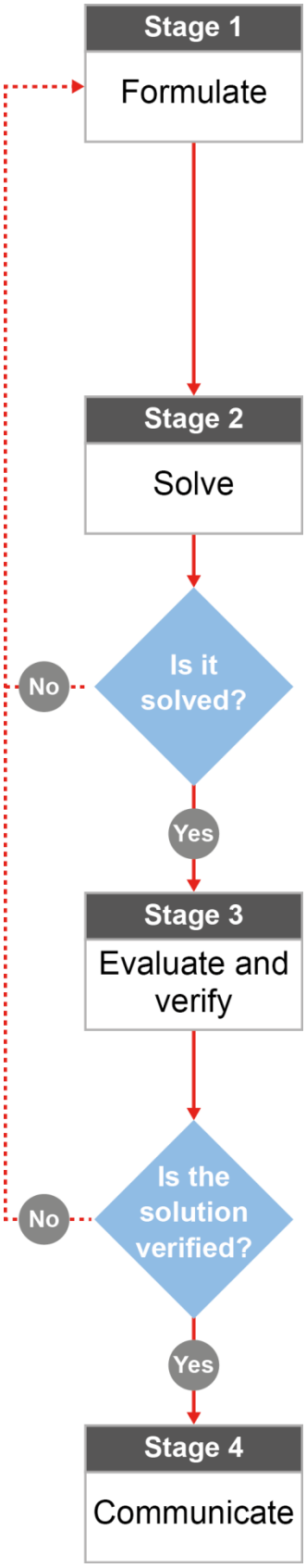
☐ Four weeks after issue date: Students submit their final response.

Authentication strategies

- The teacher will provide class time for task completion.
- Students will each produce a unique response by using individualised data and producing a unique report.
- Students will provide documentation of their progress at indicated checkpoints.
- Students will use plagiarism-detection software at submission of the response.
- Students must acknowledge all sources.
- Students must submit a declaration of authenticity.
- The teacher will ensure class cross-marking occurs.

Scaffolding

The approach to problem-solving and mathematical modelling must be used.



Translate the problem into a mathematically purposeful representation by:

- considering the variables you will be measuring
- identifying and documenting any assumptions and observations you make related to collecting data and completing your analysis
- discussing the statistical concepts and techniques required to mathematise and then solve this problem
- considering how you will incorporate the use of technology to assist with your strategy.

Select and apply mathematical and statistical procedures, concepts and techniques previously learnt to investigate this task.

The model/s developed should clearly demonstrate the nature of the relationships between the heights of the parent and child of matching gender.

Solutions can be found using algebraic, graphical and/or numeric methods. The use of technology is required.

Once you have achieved a possible solution, consider the reasonableness of the solution. Are there any other variables that need to be considered?

Evaluate your results and make a judgment about the solution.

Justify decisions made by explaining your statistical reasoning.

Revisit your initial assumptions and observations and refine these, if necessary, accommodating any unexpected findings.

Assess the strengths and limitations of your findings, using appropriate statistical techniques. Where necessary, this will require you to go back through the process to further refine the model/s. Check that the output of your model provides a valid solution to the problem.

Communicate your findings systematically and concisely using mathematical, statistical and everyday language. Draw conclusions, discussing the key results and the strengths and limitations of the solution and/or model.

Ensure you have a report that can be read independently of the task with an introduction, body and conclusion, and that you have answered the original problem posed.

Instrument-specific marking guide (IA1): Problem-solving and modelling task (20%)

Criterion: Formulate

Assessment objectives

1. select, recall and use facts, rules definitions and procedures drawn from Unit 3 Topics 1, 2 and/or 3
2. comprehend mathematical concepts and techniques drawn from Unit 3 Topics 1, 2 and/or 3
5. justify procedures and decisions by explaining mathematical reasoning

The student work has the following characteristics:	Marks
• documentation of appropriate assumptions • accurate documentation of relevant observations • accurate translation of all aspects of the problem by identifying mathematical concepts and techniques.	3–4
• statement of some assumptions • statement of some observations • translation of simple aspects of the problem by identifying mathematical concepts and techniques.	1–2
• does not satisfy any of the descriptors above.	0

Criterion: Solve

Assessment objectives

1. select, recall and use facts, rules, definitions and procedures drawn from Unit 3 Topics 1, 2 and/or 3
6. solve problems by applying mathematical concepts and techniques drawn from Unit 3 Topics 1, 2 and/or 3

The student work has the following characteristics:	Marks
• accurate use of complex procedures to reach a valid solution • discerning application of mathematical concepts and techniques relevant to the task • accurate and appropriate use of technology.	6–7
• use of complex procedures to reach a reasonable solution • application of mathematical concepts and techniques relevant to the task • use of technology.	4–5
• use of simple procedures to make some progress towards a solution • simplistic application of mathematical concepts and techniques relevant to the task • superficial use of technology.	2–3
• inappropriate use of technology or procedures.	1
• does not satisfy any of the descriptors above.	0

Criterion: Evaluate and verify

Assessment objectives

4. evaluate the reasonableness of solutions
5. justify procedures and decisions by explaining mathematical reasoning

The student work has the following characteristics:	Marks
• evaluation of the reasonableness of solutions by considering the results, assumptions and observations • documentation of relevant strengths and limitations of the solution and/or model • justification of decisions made using mathematical reasoning.	4–5
• statements about the reasonableness of solutions by considering the context of the task • statements of relevant strengths and limitations of the solution and/or model • statements about decisions made relevant to the context of the task.	2–3
• statement about a decision and/or the reasonableness of a solution.	1
• does not satisfy any of the descriptors above.	0

Criterion: Communicate

Assessment objective

3. communicate using mathematical, statistical and everyday language and conventions

The student work has the following characteristics:	Marks
• correct use of appropriate technical vocabulary, procedural vocabulary and conventions to develop the response • coherent and concise organisation of the response, appropriate to the genre, including a suitable introduction, body and conclusion, which can be read independently of the task sheet.	3–4
• use of some appropriate language and conventions to develop the response • adequate organisation of the response.	1–2
• does not satisfy any of the descriptors above.	0