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Mathematical Methods 2025 v1.2

IA1: Sample assessment instrument

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	sample only
Student number	sample only
Teacher	sample only
Issued	sample only
Due date	sample only

Marking summary

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

Conditions

Technique	Problem-solving and modelling task
Unit	Unit 3: Further calculus and introduction to statistics
Topic/s	Topic 1: Differentiation of exponential and logarithmic functions Topic 3: Further applications of differentiation Topic 4: Introduction to integration
Duration	Students will use 3 hours of class time and their own time to develop their response
Mode / length	Written: Up to 10 A4 pages, up to 2000 words
Individual / group	Individual
Other	Appendixes can include raw data, repeated calculations, evidence of authentication and student notes (appendixes are not marked). Students must use technology, e.g. scientific calculator, graphics calculator, spreadsheet program and/or other mathematical software; use of technology must go beyond simple computation or word processing.

Context

Sprint races (100 m, 200 m, and 400 m) are among the most prestigious of Olympic events. Thus, considerable effort is put into training and strategising to maximise performance. In this task you will create mathematical models of an elite sprinter's race with the aim of identifying the most effective area of improvement for the athlete to focus on.

Task

You will formulate at least two mathematical models to describe the sprint of an elite sprinter in a 100 m, 200 m or 400 m sprint race. You should use non-polynomial models. From these models, you will select the best one and analyse it to make recommendations as to how the sprinter could improve their time.

The World Athletics website (https://worldathletics.org/about-iaaf/documents/research-centre) contains split times from a number of athletics world championships. You may use this, or another source approved by your teacher, upon which to base your model.

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 instrument task sheet
- develop a unique response.

Checkpoints

☐ One week after issue date: Students email evidence of their progress to their teacher.

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

☐ Three weeks after issue date: Students email a draft for feedback. General feedback on drafts is provided to the class, but no individual corrections are made.

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

Authentication strategies

- You will be provided class time for task completion.
- Your teacher will collect copies of your response and monitor at key junctures.
- You must acknowledge all sources.
- Your teacher will ensure class cross-marking occurs.
- You will each produce a unique response by using individualised data and producing a unique report.
- You will use plagiarism-detection software to submit your response.
- You will provide documentation of your progress at indicated checkpoints.

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

Formulate	Marks
The student response has the following characteristics:	
• justified statements of important assumptions • justified statements of important observations • justified mathematical translation of important aspects of the task	3–4
• statement of a relevant assumption • statement of a relevant observation • mathematical translation of an aspect of the task.	1–2
The student response does not satisfy any of the descriptors above.	0

Solve	Marks
The student response has the following characteristics:	
• accurate use of mathematical knowledge for important aspects of the task • efficient use of technology • a complete solution	6–7
• use of mathematical knowledge for an important aspect of the task • use of technology • substantial progress towards a solution	4–5
• simplistic use of mathematical knowledge relevant to the task • simplistic use of technology • progress towards a solution	2–3
• inappropriate use of mathematical knowledge or technology.	1
The student response does not satisfy any of the descriptors above.	0

Evaluate	Marks
The student response has the following characteristics:	
• verified results • justified statements about the reasonableness of the solution by considering the assumptions • justified statements about the reasonableness of the solution by considering the observations • justified statements of relevant strengths of the solution • justified statements of relevant limitations of the solution	4–5
• a verified result • statement about the reasonableness of the solution by considering an assumption or observation • statement of a relevant strength or relevant limitation of the solution	2-3
• statement about the reasonableness of a result or the solution • statement of a strength or limitation.	1
The student response does not satisfy any of the descriptors above.	0

Communicate	Marks
The student response has the following characteristics:	
• correct use of appropriate mathematical language • logical organisation of the response, which can be read independently of the task sheet • justification of decisions using mathematical reasoning	3–4
• use of some appropriate mathematical language • adequate organisation of the response • statement of a relevant decision.	1-2
The student response does not satisfy any of the descriptors above.	0