Essential Mathematics 2019 v1.1

IA3 sample assessment instrument

September 2018

Problem-solving and modelling task

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

Assessment objectives

This assessment instrument is used to determine student achievement in the following objectives:

1. select, recall and use facts, rules, definitions and procedures drawn from Fundamental topic: Calculations and Unit 4 Topics 1 and 3

2. comprehend mathematical concepts and techniques drawn from Fundamental topic: Calculations and Unit 4 Topics 1 and 3

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

4. evaluate the reasonableness of solutions

5. justify procedures and decisions by explaining mathematical reasoning

6. solve problems by applying mathematical concepts and techniques drawn from Fundamental topic: Calculations and Unit 4 Topics 1 and 3.

Subject	Essential Mathematics	Instrument no.	IA3
Technique	Problem-solving and modelling task		
Unit	4: Graphs, chance and loans		
Topic	Fundamental topic: Calculations 1: Bivariate graphs 3: Loans and compound interest		

Conditions			
Duration	5 weeks (including 10 hours of class time)		
Mode	Written report	Length	• up to 8 pages (including tables, figures and diagrams) • maximum of 1000 words • appendixes can include raw data, repeated calculations, evidence of authentication and student notes (appendixes are not to be marked)
Individual/ group	Individual	Other	—
Resources available	The use of technology is required, e.g. • graph/spreadsheet program • any type of calculator • internet.		

Context

Albert Einstein reportedly said, 'Compound interest is the eighth wonder of the world. He who understands it, earns it. He who doesn't, pays it.'

An important aspect of managing money is understanding how to make the most of compound interest and loans. Compound interest means interest is earnt on the interest. Over time, this can mean a significant return on investments. Loans are often used to buy a house or a car. However, it is important to ensure that the repayments can be made.

Charlotte is 21 and has just started a full-time job. For her 21st birthday, her grandparents gave her some money to either invest or put towards buying a car or a house.

As Charlotte's financial adviser, you must help her decide how to best use her money to achieve her financial goals.

Task

You are to develop recommendations for Charlotte to help her achieve two of her financial goals. Her goals include:
1. buying a car
2. paying off her credit card debt
3. establishing a savings account
4. buying a house.

Your teacher will give you Charlotte's current financial information, including:
• her gross annual salary
• her current credit card debt
• the amount of money Charlotte received from her grandparents.

Your response will be in the form of a report to give to Charlotte. The report should outline different options and considerations for her financial goals so Charlotte can prioritise them.

To complete this task, you must:
• consider the stimulus information • use your knowledge of the subject matter from Unit 4 Topics 1 and 3 to investigate the problem • ensure you cover both simple and complex subject matter • ensure your response demonstrates characteristics in the instrument-specific standards • develop a unique response in a coherent and concise written format that is appropriate to the genre, and includes a suitable introduction, body and conclusion • show all calculations to support your response • follow the approach to problem-solving and mathematical modelling used in the syllabus • use a spreadsheet to demonstrate relevant calculations.

Stimulus

Charlotte's current financial information:
• gross annual salary:
• credit card debt:
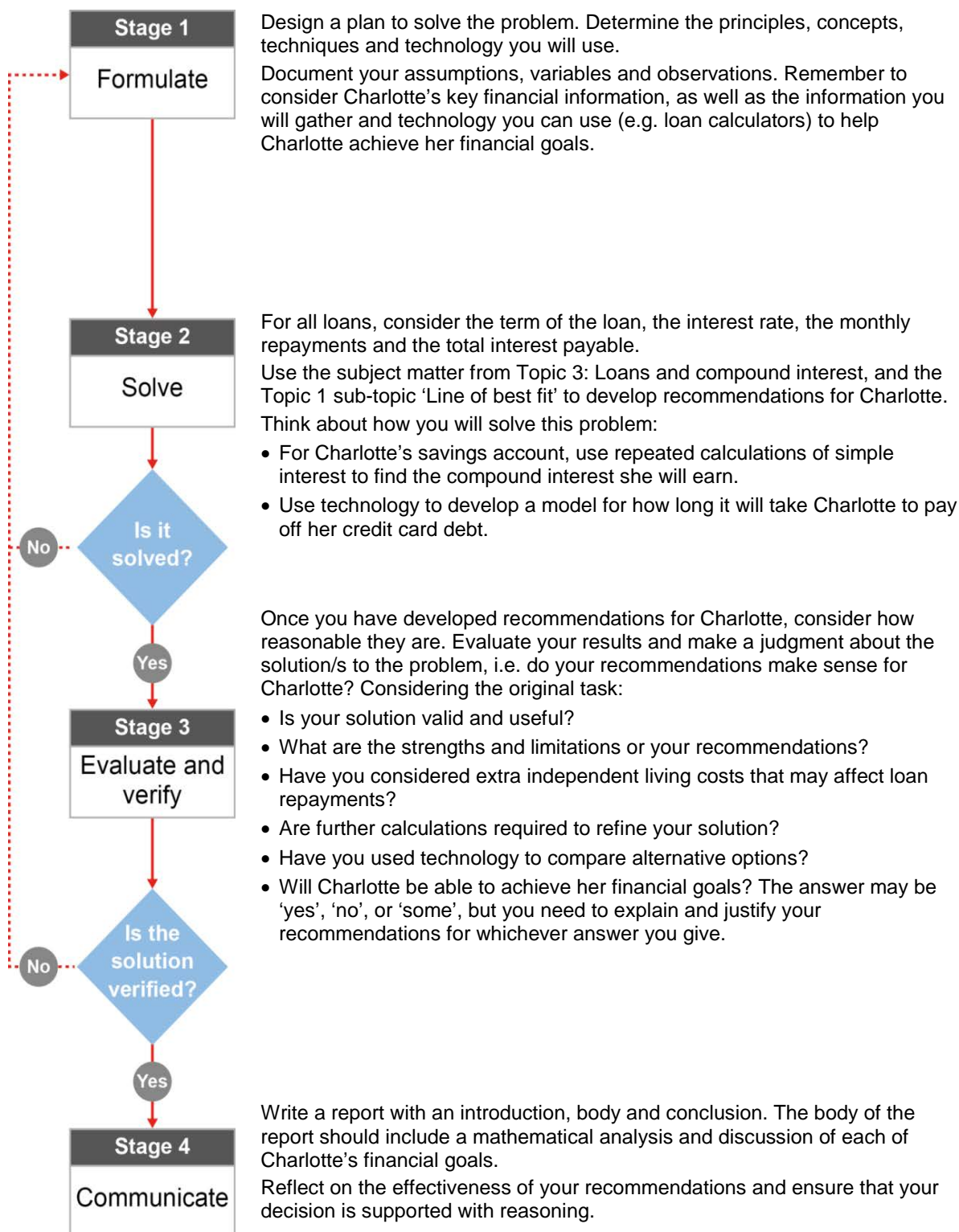• gift from grandparents:

Checkpoints

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

☐ Two weeks after issue date: Teacher sights evidence of student progress in class and records progress.

☐ Three weeks after issue date: Students email a draft to the teacher.

☐ Four weeks after issue date: Teacher provides a summary of feedback and advice to the whole class.

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

Criterion	Grade allocated	Result
Formulate Assessment objectives 1, 2, 5		
Solve Assessment objectives 1, 6		
Evaluate and verify Assessment objectives 4, 5		
Communicate Assessment objective 3		
Total	**A–E**	

Authentication strategies
• The teacher will provide class time for task completion.
• Students will provide documentation of their progress at each checkpoint.
• Students will use plagiarism-detection software at submission of the response.
• Students must submit a declaration of authenticity.
• Students will each produce a unique response by using individualised financial information.
• The teacher will ensure class cross-marking occurs.
Scaffolding
The task-specific approach to problem-solving and mathematical modelling must be used (see next page).

Approach to problem-solving and mathematical modelling

Stage 1

Formulate

Design a plan to solve the problem. Determine the principles, concepts, techniques and technology you will use.

Document your assumptions, variables and observations. Remember to consider Charlotte's key financial information, as well as the information you will gather and technology you can use (e.g. loan calculators) to help Charlotte achieve her financial goals.

Stage 2

Solve

For all loans, consider the term of the loan, the interest rate, the monthly repayments and the total interest payable.

Use the subject matter from Topic 3: Loans and compound interest, and the Topic 1 sub-topic 'Line of best fit' to develop recommendations for Charlotte.

Think about how you will solve this problem:

- For Charlotte's savings account, use repeated calculations of simple interest to find the compound interest she will earn.
- Use technology to develop a model for how long it will take Charlotte to pay off her credit card debt.

Is it solved?

No

Yes

Stage 3

Evaluate and verify

Once you have developed recommendations for Charlotte, consider how reasonable they are. Evaluate your results and make a judgment about the solution/s to the problem, i.e. do your recommendations make sense for Charlotte? Considering the original task:

- Is your solution valid and useful?
- What are the strengths and limitations or your recommendations?
- Have you considered extra independent living costs that may affect loan repayments?
- Are further calculations required to refine your solution?
- Have you used technology to compare alternative options?
- Will Charlotte be able to achieve her financial goals? The answer may be 'yes', 'no', or 'some', but you need to explain and justify your recommendations for whichever answer you give.

Is the solution verified?

No

Yes

Stage 4

Communicate

Write a report with an introduction, body and conclusion. The body of the report should include a mathematical analysis and discussion of each of Charlotte's financial goals.

Reflect on the effectiveness of your recommendations and ensure that your decision is supported with reasoning.

Instrument-specific standards

Formulate	Solve	Evaluate and verify	Communicate	Grade
The student work has the following characteristics:				
• documentation of appropriate assumptions • accurate documentation of relevant observations • accurate translation of all simple and complex aspects of the problem by identifying mathematical concepts and techniques.	• accurate use of complex procedures to reach a valid solution • discerning application of simple and complex mathematical concepts and techniques relevant to the task • accurate and appropriate use of technology.	• 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.	• 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.	A
• statements of appropriate assumptions • statements of relevant observations • translation of simple and complex aspects of the problem by identifying mathematical concepts and techniques.	• use of complex procedures to reach a reasonable solution • application of simple and complex mathematical concepts and techniques relevant to the task • appropriate use of technology.	• statements about the reasonableness of solutions by considering the context of the task • statements about relevant strengths and limitations of the solution and/or model • statements about decisions made relevant to the context of the task.	• use of technical vocabulary, procedural vocabulary and conventions to develop the response • organisation of the response, including a suitable introduction, body and conclusion.	B
• statement of assumptions • statement of observations • translation of simple aspects of the problem by identifying mathematical concepts and techniques.	• use of simple procedures to make some progress towards a solution • application of simple mathematical concepts and techniques relevant to the task • use of technology.	• statement about the reasonableness of solutions • statement about strengths and/or limitations of the solution and/or model • statement about decisions made.	• use of some appropriate language and conventions to develop the response • adequate organisation of the response.	C
• statement of an assumption or an observation • translation of some simple aspects of the problem by identifying mathematical concepts and techniques.	• application of some simple procedures, mathematical concepts or techniques • superficial use of technology.	• statement about a decision and/or the reasonableness of a solution.	• use of everyday language to develop a response • basic organisation of the response.	D
• statement of an assumption, observation or translation of an aspect of the problem.	• inappropriate use of technology or procedures.	• inappropriate statement about a decision or the reasonableness of a solution.	• unclear and disjointed organisation of the response.	E