Mathematical Methods 2016–2022

School-assessed coursework report

This report is prepared following the first year of implementation of this study provides advice based on the School-based Assessment Audit and VCAA statistical data.

General comments

The 2016 school-based assessment audit showed that most teachers had followed the requirements for the School-sssessed coursework of the revised study design and implemented them effectively.

It is important that teachers are familiar with the VCAA publication [*Mathematical Methods Advice for teachers*](https://www.vcaa.vic.edu.au/curriculum/vce/vce-study-designs/mathematicalmethods/advice-for-teachers/Pages/Index.aspx), which includes: advice about School-assessed Coursework, sample application tasks and modelling or problem-solving tasks (a Word document that can be used as a template from which teachers can develop their own tasks), and [performance criteria](https://www.vcaa.vic.edu.au/curriculum/vce/vce-study-designs/mathematicalmethods/advice-for-teachers/Pages/Units3and4PerformanceCriteria.aspx) with sample assessment record sheets for both the application task and modelling or problem-solving tasks. These performance criteria may be used is several ways:

* directly in conjunction with the sample record sheets and teacher annotations for pointers with respect to key aspects of the task related to each criterion for the outcomes
* directly with the descriptive text for each criterion modified to incorporate task specific elements as applicable
* as a template for teachers to develop their own criteria and descriptive text for each criterion, including an allocation of marks for the criteria with the total mark allocation for each outcome as specified in the study design.

Alternatively, teacher developed global descriptors, rubrics or marking schemes may be used for assessment. If these are used, they need to be clearly aligned with, and mapped to, the weightings for the outcomes for tasks as specified in the study design, and the corresponding aspects, components or parts of these tasks as applicable. Whatever approach is used, the weightings for the outcomes underpin both the design of a task, and the assessment of student responses to that task.

School-assessed Coursework enhances validity of student assessment by providing the opportunity for a context to be explored mathematically in greater depth and breadth than is possible in an examination, with non-routine and open-ended elements and aspects engaged in more fully. The tasks for School-assessed Coursework are to be implemented over a longer continuous period, where modelling, problem-solving, or investigative techniques or approaches are employed, and the related use of technology as a tool for working mathematically suitably incorporated. This is specified as 4–6 hours over a period of 1–2 weeks for the application task, and 2–3 hours over a period of one week for a modelling or problem-solving task. Multiple-choice items are not suitable for either an application task or a modelling or problem-solving task.

The context on which a task is based may be practical, theoretical or a combination of both. Students should consider assumptions, definitions, conditions and constraints involved, make decisions involving general case analysis and communicate key stages of mathematical reasoning: formulation, solution, and interpretation with respect to the context.
Various materials and resources from third party sources may be drawn on to assist with developing suitable tasks; however, it is the responsibility of teachers to ensure that tasks based on these materials and resources are developed in accordance with the requirements of the study design, and that authentication of student work is suitably addressed.

The audit questionnaire is intended to assist teachers in checking their planning for implementation of School-assessed Coursework as well as providing feedback to the VCAA. While many teachers readily completed the questionnaire, some commented that the timeline to answer the audit questions was too early for their school’s planning. Others commented that the process was time-consuming and that they were only able to provide preliminary or indicative responses for some stages or aspects of implementation.

For queries about School-assessed coursework for Mathematical Methods, contact Dr. David Leigh-Lancaster VCAA Mathematics Curriculum Manager: (03) 9032 1690 or email: leigh-lancaster.david.d@edumail.vic.gov.au

For queries about the coursework audit process or audit questionnaire, contact the VCE Curriculum Unit: (03) 9032 1735 or email: school.assessment.vcaa@edumail.vic.gov.au

Specific information

For each unit the student is required to demonstrate achievement of three outcomes. As a set these outcomes encompass all of the selected areas of study for each unit. For each of Unit 3 and Unit 4 the outcomes as a set apply to the content from the areas of study covered in that unit.
A task for School-assessed Coursework need not cover all of the content from an area of study, or all of the key knowledge and key skills for an outcome.

Unit 3 coursework

The set of three outcomes apply to the application task.

Outcome 1

Define and explain key concepts as specified in the content from the areas of study, and apply a range of related mathematical routines and procedures.

Outcome 2

Apply mathematical processes in non-routine contexts, including situations requiring problem-solving, modelling or investigative techniques or approaches, and analyse and discuss these applications of mathematics.

Outcome 3

Select and appropriately use numerical, graphical, symbolic and statistical functionalities of technology to develop mathematical ideas, produce results and carry out analysis in situations requiring problem-solving, modelling or investigative techniques or approaches.

Application task

The application task is a function and calculus-based mathematical investigation of a practical or theoretical context involving content from two or more areas of study, with the following three components of increasing complexity:

* introduction of the context through specific cases or examples
* consideration of general features of the context
* variation or further specification of assumption or conditions involved in the context to focus on a particular feature or aspect related to the context.

The application task is to be of 4–6 hours duration over a period of 1–2 weeks.

An Application task is a function and calculus-based mathematical investigation, based on a context involving content from two or more areas of study. Typically, this covers a selection of content from the Calculus area of study and the Functions and graphs, and Algebra areas of study appropriate to that stage of implementation of Unit 3, as applicable to the context.

An application task has three components of increasing complexity. The first component should be designed so that students understand and engage in the context for investigation through specific cases or examples. In this component of the task, the mathematics involved and its application should be familiar and routine.

The second component, consideration of general features of the context, involves extending and generalising formulation and application introduced in the first component so that the context is explored in greater breadth and/or depth. This will typically include more open-ended work, with some unfamiliar and non-routine aspects considered. Parameters used to characterise families of functions, solutions of equations and the identification and analysis of key features are typically involved in this component of an application task.

The third component,variation or further specification of assumption or conditions involved in the context to focus on a particular feature or aspect related to the context, provides the opportunity for a particular feature or aspect of the context, or a related context, to be explored in some depth. This may occur through including additional constraints or conditions, varying constraints or conditions, or the types of functions and/or combinations involved.

While Outcome 1 and Outcome 3 and the related key knowledge and key skills will be covered across all three components of an application task, for Outcome 2, the related key knowledge and key skills are likely to have particular focus with respect to the second and third components of an application task.

Some of the application tasks reviewed as further evidence through the audit had a structure more like an extended collection of Examination 2 type questions with limited progression through the three components for an application task. While various hints and suggestions can be included to assist students as they progress through the components of a task, these should not, in general, be directive or prescriptive with respect to the methods and approaches that students use in their investigation of the context.

The scheduling of the application task in Unit 3 depends on the lengths of Terms 1 and 2, and the coverage and consolidation of content from the Functions and graphs, Algebra and Calculus areas of study. Early in Term 2 was a common time for the application task to be run.

Unit 4 coursework

The set of three outcomes applies to each of the two modelling or problem-solving tasks, one of which is to be related to the probability and statistics area of study.

Outcome 1

Define and explain key concepts as specified in the content from the areas of study, and apply a range of related mathematical routines and procedures.

Outcome 2

Apply mathematical processes in non-routine contexts, including situations requiring problem-solving, modelling or investigative techniques or approaches, and analyse and discuss these applications of mathematics.

Outcome 3

Select and appropriately use numerical, graphical, symbolic and statistical functionalities of technology to develop mathematical ideas, produce results and carry out analysis in situations requiring problem-solving, modelling or investigative techniques or approaches.

Modelling or problem-solving tasks

The modelling or problem-solving tasks are to be of 2–3 hours duration over a period of one week, and one of the two modelling or problem-solving tasks is to be related to the Probability and statistics area of study.

Each task can be either a modelling task or a problem-solving task. A task may be designated as a modelling task or a problem-solving task based on the context and the nature and emphasis of the processes involved in relation to the context under consideration. Some of the contexts used included: waves at the beach, regulations for heights of historic buildings, hikes in the bush, lighting in the city, Ferris wheels, Olympic events, and the 2016 US presidential election.

The modelling or problem-solving tasks that were not related to the Probability and statistics area of study were generally based in real-life contexts, where both differentiation and integration could be applied. In many cases a modelling scenario or a problem was suitably developed, progressing from easier routine aspects at the beginning to more difficult analysis of non-routine aspects, often involving the use of parameters.

Many of the modelling or problem-solving tasks related to the Probability and statistics area of study incorporated material related to statistical inference, and drew on the types of scenarios used in Examination 2 extended response questions. As teachers become familiar with a repertoire of scenarios and range of sources of data related to this content, they are encouraged to use them to develop related modelling and problem-solving tasks including the use of simulation of random sampling.

For both of the Unit 4 modelling or problem-solving tasks some of the tasks presented during the audit were more of the nature of a large collection of Examination 2 extended response questions across several contexts than a modelling or problem-solving task based on a particular context explored in some depth. These tasks tended to be more directive in terms of expected response from students.