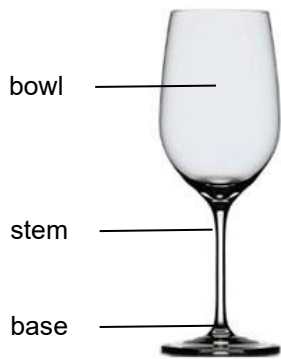


## Stage 2 Specialist Mathematics

### Assessment Type 2: Mathematical Investigation

#### Topic 5 – Integration Techniques and Applications

Mathematics can be used to model the shapes of objects. In the first part of this investigation the cross section of the bowl of a wine glass is modelled with the aim to mathematically obtain a reasonable volume of the glass. The second part of the investigation allows different objects to be modelled to find their volume.



Wine glass

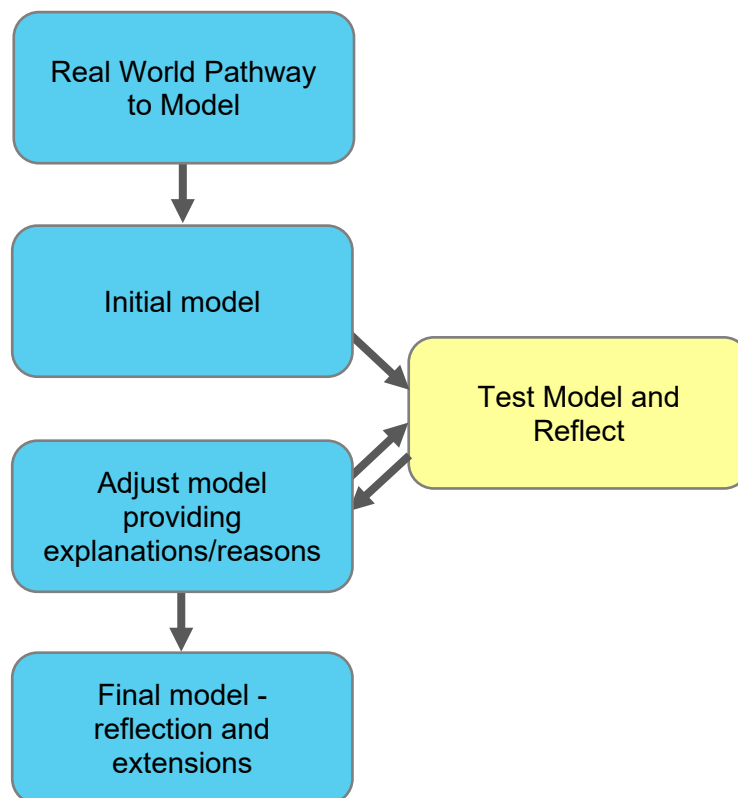
Ensure the following points are addressed in this investigation.

#### Wine Glass:

- Mathematically model the shape of the cross-section of the bowl of a chosen wine glass.
- You *may* use your knowledge of inverse functions to find a 1-1 function to rotate about the  $x$ -axis, or otherwise, to find the volume of the glass.
- Investigate adjusting your model (see the flow chart on page 2) to improve the accuracy of the volume calculated compared to the actual volume of the chosen wine glass.
- Discuss the reasonableness of the results.

#### Another Object:

- Consider another object and find its actual volume discussing the process used.
- Develop a mathematical model to find an approximate volume. Use the flow chart on page 2 to adjust the model to improve the answer you have found mathematically.
- Compare the actual volume and calculated volume and discuss the reasonableness of the results.



The format of the investigation report may be written or multimodal. The report should include the following:

- an outline of the problem and context
- the method required to find a solution, in terms of the mathematical model or strategy used
- the application of the mathematical model or strategy, including
  - relevant data and/or information
  - mathematical calculations and results, using appropriate representations
  - the analysis and interpretation of results, including consideration of the reasonableness and limitations of the results
- the results and conclusions in the context of the problem.

A bibliography and appendices, as appropriate, may be used.

The investigation report, excluding bibliography and appendices if used, must be a maximum of 12 A4 pages if written, or the equivalent in multimodal form. The maximum page limit is for single-sided A4 pages with minimum font size 10. Page reduction, such as 2 A4 pages reduced to fit on 1 A4 page, is not acceptable. Conclusions, interpretations and/or arguments that are required for the assessment must be presented in the report, and not in an appendix. Appendices are used only to support the report, and do not form part of the assessment decision.

## Performance Standards for Stage 2 Specialist Mathematics

Concepts and Techniques		Reasoning and Communication
<b>A</b>	<p>Comprehensive knowledge and understanding of concepts and relationships.</p> <p>Highly effective selection and application of mathematical techniques and algorithms to find efficient and accurate solutions to routine and complex problems in a variety of contexts.</p> <p>Successful development and application of mathematical models to find concise and accurate solutions.</p> <p>Appropriate and effective use of electronic technology to find accurate solutions to routine and complex problems.</p>	<p>Comprehensive interpretation of mathematical results in the context of the problem.</p> <p>Drawing logical conclusions from mathematical results, with a comprehensive understanding of their reasonableness and limitations.</p> <p>Proficient and accurate use of appropriate mathematical notation, representations, and terminology.</p> <p>Highly effective communication of mathematical ideas and reasoning to develop logical and concise arguments.</p> <p>Effective development and testing of valid conjectures, with proof.</p>
<b>B</b>	<p>Some depth of knowledge and understanding of concepts and relationships.</p> <p>Mostly effective selection and application of mathematical techniques and algorithms to find mostly accurate solutions to routine and some complex problems in a variety of contexts.</p> <p>Some development and successful application of mathematical models to find mostly accurate solutions.</p> <p>Mostly appropriate and effective use of electronic technology to find mostly accurate solutions to routine and some complex problems.</p>	<p>Mostly appropriate interpretation of mathematical results in the context of the problem.</p> <p>Drawing mostly logical conclusions from mathematical results, with some depth of understanding of their reasonableness and limitations.</p> <p>Mostly accurate use of appropriate mathematical notation, representations, and terminology.</p> <p>Mostly effective communication of mathematical ideas and reasoning to develop mostly logical arguments.</p> <p>Mostly effective development and testing of valid conjectures, with substantial attempt at proof.</p>
<b>C</b>	<p>Generally competent knowledge and understanding of concepts and relationships.</p> <p>Generally effective selection and application of mathematical techniques and algorithms to find mostly accurate solutions to routine problems in a variety of contexts.</p> <p>Successful application of mathematical models to find generally accurate solutions.</p> <p>Generally appropriate and effective use of electronic technology to find mostly accurate solutions to routine problems.</p>	<p>Generally appropriate interpretation of mathematical results in the context of the problem.</p> <p>Drawing some logical conclusions from mathematical results, with some understanding of their reasonableness and limitations.</p> <p>Generally appropriate use of mathematical notation, representations, and terminology, with reasonable accuracy.</p> <p>Generally effective communication of mathematical ideas and reasoning to develop some logical arguments.</p> <p>Development and testing of generally valid conjectures, with some attempt at proof.</p>
<b>D</b>	<p>Basic knowledge and some understanding of concepts and relationships.</p> <p>Some selection and application of mathematical techniques and algorithms to find some accurate solutions to routine problems in some contexts.</p> <p>Some application of mathematical models to find some accurate or partially accurate solutions.</p> <p>Some appropriate use of electronic technology to find some accurate solutions to routine problems.</p>	<p>Some interpretation of mathematical results.</p> <p>Drawing some conclusions from mathematical results, with some awareness of their reasonableness or limitations.</p> <p>Some appropriate use of mathematical notation, representations, and terminology, with some accuracy.</p> <p>Some communication of mathematical ideas, with attempted reasoning and/or arguments.</p> <p>Attempted development or testing of a reasonable conjecture.</p>
<b>E</b>	<p>Limited knowledge or understanding of concepts and relationships.</p> <p>Attempted selection and limited application of mathematical techniques or algorithms, with limited accuracy in solving routine problems.</p> <p>Attempted application of mathematical models, with limited accuracy.</p> <p>Attempted use of electronic technology, with limited accuracy in solving routine problems.</p>	<p>Limited interpretation of mathematical results.</p> <p>Limited understanding of the meaning of mathematical results, their reasonableness, or limitations.</p> <p>Limited use of appropriate mathematical notation, representations, or terminology, with limited accuracy.</p> <p>Attempted communication of mathematical ideas, with limited reasoning.</p> <p>Limited attempt to develop or test a conjecture.</p>