

Stage 2 Specialist Mathematics
Assessment Type 2: Mathematical Investigation
Modelling pathways with parametric curves

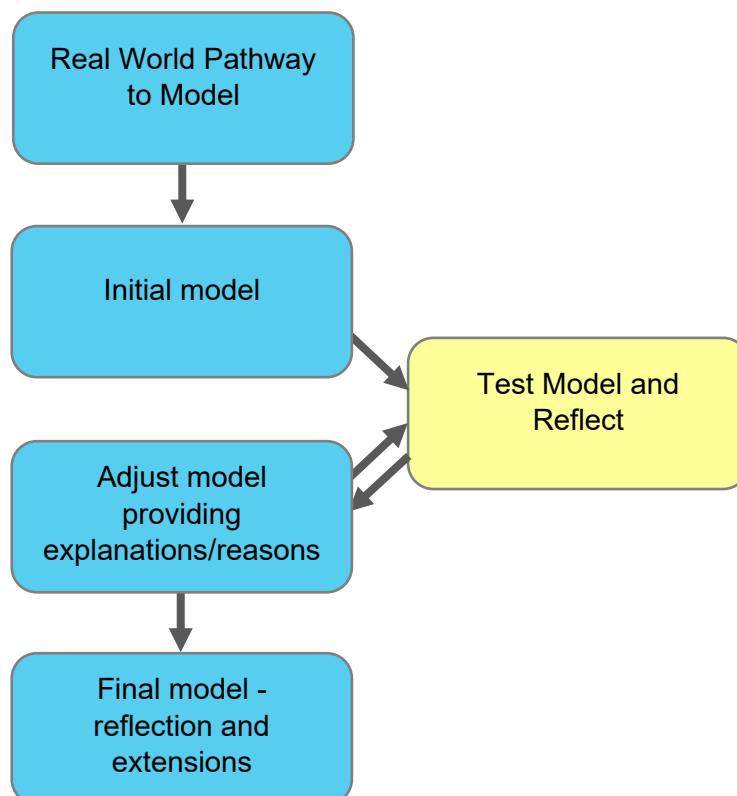
Parametric Equations may be used to model the movement of particles or model objects in 3 dimensions (3D). Some examples of real world occurrences that can be modelled are listed below:

- Missiles and interception
- Golf swing
- Trapeze, gymnasts, trampoline work
- Stunt motorcycles/bicycles
- Spiral staircases

Using knowledge of concepts from Subtopic 6.3 (Pairs of Varying Quantities), model the movement of particles in 3D or model objects in 3D using parametric curves. Throughout the development of the model detailed explanations of, and reasons for, the modifications made should be provided.

The model should be as realistic as possible and throughout the mathematical investigation limitations of the model developed at all stages should be considered.

The flowchart below provides a guide on the steps to follow in developing the model.



Within the investigation

- provide graphs of the situation and analyse, where appropriate, the speed of objects or points, maxima and minima relevant to the path, and arc length of curves.
- present clear reasoning for changes made to the model.

The format of an investigation report may be written or multimodal.

The 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 |
|-------------------------|--|---|
| A | <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 | <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> |
| C | <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> |
| D | <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> |
| E | <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> |