# MATHEMATICS METHODS (MTM415117)

External Assessment Specifications inform the development of external assessments. The primary audience for this document is the course Setting Examiner and Exam Critics. It may also be of use to teachers and students.

These specifications must be read in conjunction with the current Course Document on the TASC website.

The external assessment for this course consists of a written exam.

## WRITTEN EXAM STRUCTURE

The written exam is THREE hours.

Students will have an additional 15-minute preparation time during which students can take notes on the note paper provided and highlight any key words in the exam booklet during the allocated time. Students will not be permitted to start their exam until advised by the Exam Supervisor.

The written exam is divided into TWO sections, each with FIVE parts.

Section A and Section B are of unequal weighting as indicated by time and mark allocations.

The sections are in two separate question-and-response booklets.

Section A is collected 80 minutes after exam commencement, from which time calculators may be used. (Section B can be commenced at any stage without calculator usage in the 80 minute period.)

The criteria to be externally assessed are:

Criterion 4: understand polynomial, hyperbolic, exponential and logarithmic functions

Criterion 5: understand circular functions

Criterion 6: use differential calculus in the study of functions

Criterion 7: use integral calculus in the study of functions

Criterion 8: understand binomial and normal probability distributions and statistical inference

## SPECIFIC MATERIALS AND EQUIPMENT APPROVED FOR USE BY STUDENTS

- Current TASC MTM415117 Mathematics Methods Information Sheet
- TASC approved calculators



OFFICE OF TASMANIAN ASSESSMENT, STANDARDS & CERTIFICATION

# ASSESSMENT

All criteria are assessed numerically with marks out of 36.

A representative sample, encompassing a large proportion of the targeted course content areas, tests the standard of skills, knowledge and understanding of a student.

- The relative weighting of questions is indicated by
  - The relative allocation of marks, and
  - Space for responses
  - Items of questions (for example 1a, 1b or 1ai, 1aii) must have an individual mark allocation
  - For questions or items worth:
    - One (1) mark items, no workings are required for a correct answer
      - Correct answer with or without working = 1 mark
      - Correct answer with some incorrect working = 1 mark
      - Incorrect answer with some correct working = 0.5 mark
    - Two (2) mark items, learners are required to show relevant working
      - Correct answer with relevant working = full marks
      - Correct answer with no working = maximum 1.5 marks
      - Correct answer with some incorrect working = partial marks
      - Incorrect answer with some correct working = partial marks
      - Incorrect answer with incorrect working = no marks
    - Three (3) or more mark items, learners are required to show relevant working
      - Correct answer with relevant working = full marks
      - Correct answer with no working = maximum half marks
      - Correct answer with some incorrect working = partial works
      - Incorrect answer with some correct working = partial marks
      - Incorrect answer with incorrect working = no marks
- Approximately a mark per minute with 80 marks in Section A and 100 marks in Section B (not more questions – just more opportunity to demonstrate knowledge and understanding of relevant criteria).

A set of solutions or a marking tool will be developed by the Setting Examiner, provided to markers at the marking meeting that follows the external written exam; and will be available from TASC in the following year.

The external assessment must include questions that, separately or together, give opportunities to demonstrate the standards from rating C to rating A.

Final results will be awarded as a rating of A, B, C, t or z in the above criteria. These ratings are used in determining the final award according to the algorithm in the course document.

## Numerical Mark Allocation

Exam papers are designed so that the number of marks allocated to a section, part or question corresponds to the recommended time allocation for it. This is so that a student knows when answering a 10 mark question that the question has been designed for students to spend approximately 10 minutes reading, thinking and then answering the question. Students may find that they spend less or more time on certain questions throughout the exam.

# SECTION A

## Structure

- This section will take approximately 80 minutes and be allocated 80 marks.
- This section is divided into five parts, and each part will include between THREE and SIX questions. All questions are compulsory.
- Total allocation of 16 marks per part.
- Questions may be broken into items which will each have their own mark allocation.
- Calculators are NOT allowed to be used.

This section addresses the following course content:

- Part 1 - Functions and graphs
- Part 2 - Circular (trigonometric) functions
- Part 3 - Differential calculus
- Part 4 - Integral calculus
- Part 5 - Statistics and probability

One topic per section which are equally weighted.

## Assessed Criteria

- Criterion 4 understand polynomial, hyperbolic, exponential and logarithmic functions.
- Criterion 5 understand circular functions.
- Criterion 6 use differential calculus in the study of functions.
- Criterion 7 use integral calculus in the study of functions.

(Includes all Elements)

- Criterion 8 understand binomial and normal probability distributions and statistical inference.

(Includes all Elements except elements 3, 5, 6 where it specifies the use of technology)

## Nature of Questions

See Appendix A

## Nature of Responses

- Responses will be assessed numerically.
- All closed-ended responses.

# SECTION B

## Structure

- This section will take approximately 100 minutes and be allocated 100 marks.
- This section is divided into five parts, and each part will include between THREE and SIX questions. All questions are compulsory.
- Total allocation of 20 marks per part.
- Questions may be broken into items which will each have their own mark allocation.
- Calculators are allowed to be used.

This section addresses the following course content:

- Part 1 - Functions and graphs
- Part 2 - Circular (trigonometric) functions
- Part 3 - Differential calculus
- Part 4 - Integral calculus
- Part 5 - Statistics and probability

One topic per section which are equally weighted.

## Assessed Criteria

- Criterion 4 understand polynomial, hyperbolic, exponential and logarithmic functions.
- Criterion 5 understand circular functions.
- Criterion 6 use differential calculus in the study of functions.
- Criterion 7 use integral calculus in the study of functions.
- Criterion 8 understand binomial and normal probability distributions and statistical inference.

(Includes all Elements)

## Nature of Questions

See Appendix A

## Nature of Responses

- Responses will be assessed numerically.
- All closed-ended responses.

# Appendix A

## TYPES of Questions (All SECTIONS)

A balance of questions ranging from short to extended formats (no question or item will have more than 10 marks allocated)

Extended questions include a balance of routine and non-routine contexts.

*Short response format*

These questions are composed of a brief prompt that demands a response to some stimulus material that varies from a single response to a few written points. This sort of question is suited to assessing the student's ability:

- to recall specific information and methods related to key content
- to apply rehearsed methods to familiar situations
- to demonstrate understanding of key concepts in unseen stimulus material.

Exemplar:

Differentiate $\frac{x^4}{\cos x}$ (2 marks)

*Extended response format*

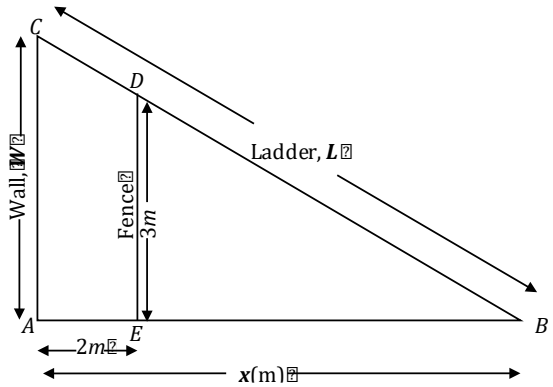
These questions involve multi-stage responses of increasing complexity. Greater complexity may be due to one or more of the following:

- A greater cognitive demand of mathematical concepts
- The necessity to select appropriate data and/or formulae
- Justification of a response via a logical line of reasoning.

Exemplar:

A ladder, $\boldsymbol{L}$, is required to just clear a 3 metre fence and lean up against a large wall, $\boldsymbol{W}$, which is positioned 2 metres behind the fence. The base of the ladder is $\boldsymbol{x}$ metres from the wall.

The diagram below represents the above information.




(a) In similar triangles, the ratio of corresponding sides are equal, hence $\frac{AC}{ED} = \frac{AB}{EB}$. (1 mark)

Use this relationship to determine an expression for $W$ in terms of $x$.

(b) Hence, show that an expression for the length, $L$, of the ladder in terms of $x$ is represented by the equation $L = \sqrt{x^2 + \frac{9x^2}{(x-2)^2}}$. (2 marks)

(c) Using a gradient table, or some other means, provide reasoning that justifies the existence of a local minimum for $L$, at $x \approx 4.62\,m$. (2 marks)

*Note: You do not need to provide an expression for* $L'(x)$.

(d) Hence, determine the minimum length of the ladder required. (1 mark)

*Express your answer in metres correct to 1 decimal place.*