

AustMS Accreditation of Degree Programs: Revision

Background

In 2002, the Australian Mathematical Society (AustMS) produced guidelines for the accreditation of degree programs in mathematics led by Ian Doust. Building on the 2002 documentation, this revision updates the existing standards and processes, including

- Content, curriculum and knowledge
- Graduate capabilities
- Connection with Australian Government acts and standards
- Inclusion of three-year mathematically-titled degrees
- The accreditation process

Context

Many professional mathematicians have some shared idea of what a body of mathematical knowledge involves for university study specialisation in mathematics (eg, content and curriculum), and which competencies mathematics graduates should have (eg, certain graduate capabilities). Many mathematics programs across Australian universities reflect this with some shared degree of uniformity.

So, why bother with an accreditation scheme at all? There are at least three strong and interconnected positions to support such a program:

- Public certification
- Quality assurance
- Defence of standards.

Since the establishment of the Tertiary Education Quality and Standards Agency (TEQSA) by the Australian Government in 2011, the national university sector has been subjected to increased scrutiny regarding quality assurance and regulation in higher education. Indeed, national legislation such as the Higher Education Standards Framework (HESF) and the Australian Quality Framework (AQF) contain somewhat broad expectations, such as typical achievements of graduates who have been awarded a bachelor or honours degree.

Discipline-level quality assurance standards and processes are clearly beyond the expertise of overarching government agencies, and this responsibility has a strong tradition of being met by professional societies. For example, for many years, professional degrees involving engineering and technology have been accredited by organisations such as Engineers Australia and the Australian Computer Society. In science, there is a tradition of accreditation in physics and chemistry by the Australian Institute of Physics and the Royal

Australian Chemical Institute, respectively. In statistics, The Statistical Society of Australia has been actively accrediting statistics degrees across Australian universities.

In establishing and developing its existing accreditation system, the AustMS aims to continue to:

- ensure high quality teaching and learning of mathematics at Australian universities
- promote and assess the capabilities that mathematics graduates should have
- provide institutions with an opportunity to demonstrate that these standards are being met.

The Accreditation Standards

The criteria listed below define a foundational set of characteristics for each of the common types of degrees that are available at Australian higher education institutions. The significance of each of the criteria will depend on the focus of the particular degree.

Three-Year Degree (AQF Level 7)

Generalist Three-Year Degree with Major in Mathematics or Mathematics and Statistics (AQF 7)

This includes: generalist degrees, such as Arts or Science, that incorporate a major in mathematics or a joint major in mathematics and statistics.

Graduates at this level will have broad, coherent mathematical knowledge and mathematical skills for professional work and/or further learning. They will possess well-developed problem-solving, technological, numeracy and communication skills in mathematics. A graduate will be able to select and apply standard mathematical theories, methods and knowledge to: analyse and evaluate information; generate solutions to problems; and to transmit mathematical knowledge, skills and ideas to others in written and oral forms. Graduates at this level will demonstrate autonomy, and well-developed judgement and responsibility in contexts that require self-directed mathematical work. Graduates will be mathematically well prepared to teach secondary school mathematics.

A typical program should contain a broad range of standard topics from across mathematics, that may include, for example: calculus; linear algebra; differential equations; statistics; discrete mathematics; complex analysis and geometry. Students should have exposure to mathematical software (eg, Maple, SAGE), proofs, and the use of mathematics in applications (eg, modelling). Methods of assessment are to be aligned with graduate capabilities or other learning outcomes.

A program of mathematical specialisation, such as a major, must have sufficient staffing and appropriate learning environments to meet the educational, academic support, administrative and access needs of the student cohorts undertaking the mathematical study. Staff must possess: knowledge of contemporary developments in mathematics; skills in teaching,

learning and assessment in mathematics; and a relevant qualification at least one level higher than is awarded for the course of study (that is, at least AQF 8), or equivalent experience. Learning environments, whether they are physical or digital, must be fit for purpose.

Students who are admitted to such a mathematics program must possess appropriate levels of mathematical preparedness, learning skills, and proficiency in English. Those at risk of not succeeding need to be identified and managed, for example, by targeted support.

Specialisation in mathematics must be reflected in the breadth and depth of the mathematical syllabus. That is, a significant proportion of the degree must involve mathematics. As a guide, this has consisted of a minimum of: 25% of first year; 33% of second year; and 50% of third year studies. Variations of this model are acceptable, however, it is unlikely that a program within a generalist degree, such as a mathematics major, would be approved in which there is less than one-third of the total degree from the mathematical sciences.

Mathematically-Titled Three-Year Degree (AQF 7)

This includes mathematically-titled degrees (eg, Bachelor of Mathematics, Bachelor of Mathematics and Statistics) that are of three years in duration. The standards involving graduate attributes are similar to those expectations for majors in mathematics and mathematics and statistics, however the volume of mathematics and statistics that students are exposed to during the degree is increased (see below).

Graduates at this level will have broad, coherent mathematical knowledge and mathematical skills for professional work and/or further learning. They will possess well-developed problem-solving, technological, numeracy and communication skills in mathematics. A graduate will be able to select and apply standard mathematical theories, methods and knowledge to: analyse and evaluate information; generate solutions to problems; and to transmit mathematical knowledge, skills and ideas to others in written and oral forms. Graduates at this level will demonstrate autonomy, and well-developed judgement and responsibility in contexts that require self-directed mathematical work. Graduates will be mathematically well prepared to teach secondary school mathematics.

Specialisation in mathematics must be reflected in the breadth and depth of the mathematical syllabus. That is, a significant proportion of the degree must involve mathematics, and contain significantly more breadth and depth than, for example, that of a mathematics major.

A typical program should contain a broad range of standard topics from across mathematics, that may include, for example: calculus; linear algebra; differential equations; statistics; discrete mathematics; complex analysis and geometry. Students should have exposure to mathematical software (eg, Maple, SAGE), proofs, and the use of mathematics in applications (eg, modelling). Methods of assessment are to be aligned with graduate capabilities or other learning outcomes.

Such a degree program of mathematical specialisation, must have sufficient staffing and appropriate learning environments to meet the educational, academic support, administrative and access needs of the student cohorts undertaking the mathematical study. Staff must possess: knowledge of contemporary developments in mathematics; skills in teaching, learning and assessment in mathematics; and a relevant qualification of at least AQF 8, or equivalent experience. Learning environments, whether they are physical or digital, must be fit for purpose.

Students who are admitted to such a mathematics program must possess appropriate levels of mathematical preparedness, learning skills, and proficiency in English. Those at risk of not succeeding need to be identified and managed, for example, by targeted support.

Four-Year Honours Degree (AQF Level 8)

A degree with Honours in mathematics or mathematics and statistics is a qualification that has greater depth and breadth than the three-year degree. It includes a fourth year of study that incorporates additional specialisation. The fourth year may be appended to generalist degrees, or it may be embedded within programs of study, such as those known, for example, as “Advanced Mathematics”.

Graduates at this level will have advanced mathematical knowledge and advanced mathematical skills for professional work and/or further learning in the postgraduate environment. They will possess advanced problem-solving, technological, numeracy and communication skills in mathematics. A graduate will be able to select and apply advanced mathematical theories, methods and technical knowledge to: analyse and evaluate information; generate solutions to problems; and to transmit knowledge, skills and ideas to others in written and oral forms. Graduates will demonstrate increased levels of autonomy, well-developed judgement, adaptability and responsibility in contexts that require self-directed mathematical work when compared against those from a three-year degree.

A typical fourth-year program should contain a combination of advanced mathematics courses and a supervised research project in mathematics. The particular topics covered will depend on the area of mathematical specialisation, but should be sufficiently deep and broad to ensure the objectives described above are met. Methods of assessment are to be aligned with graduate capabilities or other learning outcomes.

A program of mathematical specialisation, such as fourth-year Honours, must have sufficient staffing and appropriate learning environments to meet the educational, research, academic support, administrative and access needs of the student cohorts undertaking the mathematical study. Staff must possess: knowledge of contemporary developments in mathematics; skills in teaching, learning, research-training and assessment in mathematics; and a relevant qualification of at least AQF 9, or equivalent experience. Learning environments, whether they are physical or digital, must be fit for purpose.

Students who are admitted to an Honours program in mathematics must possess appropriate levels of mathematical preparedness, learning skills, and proficiency in English. Those at risk of not succeeding need to be identified and managed, for example, by targeted support.

Double Degrees

The standards and expectations for these degrees will be substantially guided by those for the Three-Year and Honours degrees outlined above.

Other Degrees

Other degrees (eg, Masters, PhD, Grad Dip etc) are currently out of scope of the AustMS accreditation. If there is sufficient demand then this can be explored in the future.

The Accreditation Process

Preliminaries

Requests for accreditation should be sent to the AustMS Secretary and usually come from the Head of the department of mathematics involved in teaching the specialisation, or some other appropriate authority involved in the program.

The Society will agree on a timetable for the review with the requestor, and appoint an appropriate group of experts to form an assessment team. Each member of the assessment team will have suitable experience in university mathematics education that is relevant to the particular program under consideration. Their role will be to assess the program under consideration against the criteria in this document and then to write a report and recommendation concerning accreditation. Reviewers and the review process will be supported by the AustMS Standing Committee on Education in terms of training, expectations, guidelines and approvals.

Fees for undertaking accreditation are currently: \$1,000 AUD plus any travel and accommodation expenses for the assessment team. Assessments can be done virtually if appropriate to do so, for example, in case travel restrictions are in effect. Payment is irrespective of the review outcome.

Conduct of the Review

An initial phase will involve the requestor providing relevant documents and other information to the assessment team regarding the program under consideration. This should include

- A statement that addresses the accreditation standards of this document illustrating how the program meets these.
- Evidence to support these claims.
- Links to handbook entries, program rules and course descriptions etc that are associated with the program.

- If some aspects of the program do not meet some of the accreditation standards, then an argument will need to be made as to how the program makes up for these omissions.
- Details of other reviews of the program, such as university program reviews, TEQSA registrations of the university.
- Any other information that the requestor deems relevant to the assessment.

It is expected that the information supplied to the assessment team will be in digital form.

A subsequent phase of assessment will involve a site visit by the assessment team. Assessments can be done in-person, or virtually if appropriate to do so, for example, in case travel restrictions are in effect. The visit would usually include

- A meeting with the requestor (or nominee). This may include discussion of any issues or updates from the initial examination of materials already provided.
- Discussions with other members of staff involved in the program under review.
- Discussions with students and alumni of the program.
- Examination of facilities, including physical and digital aspects.

A final phase of assessment will occur after the site visit, where the assessment team will produce a draft report based on an analysis of the earlier phases of the review. It will list strengths and opportunities of the program, and also a recommendation for accreditation. In the first instance, this document will be shared with the requestor for comment.

Outcome of the Review

After receiving feedback from the requestor, the assessment team will forward a finalised report to the AustMS. The Standing Committee for Education of the AustMS will make a decision regarding the granting of accreditation of the program(s) as soon as practical and then shared with the requestor. If granted, then accreditation will last for five years. Any planned changes to the accredited program must be communicated to the AustMS prior to their implementation or there is a risk that accreditation will be revoked.

If accreditation is not granted, and the requestor wishes to challenge the decision of the AustMS, then they should make a written submission to the President and Secretary of the Society, who may:

- Deny the appeal
- Request reassessment by the assessment team
- Appoint an independent assessor to provide a new report.