Final Assessment Report
Pure Mathematics (BMath, Minor)
January 2026

Executive Summary

External reviewers were invited to review the Pure Mathematics (BMath, Minor) programs delivered by the Department of Pure Mathematics.

"Students who graduate from the majors program in pure mathematics are indeed successful in continuing with postgraduate studies abroad, with many entering prestigious programs such as those at Oxford, Harvard, Stanford, and MIT. Interestingly, few graduates of the pure mathematics undergraduate program continue their graduate work in Waterloo…
The majors program is intellectually demanding and is preparing students for mathematics graduate programs. Therefore, the majors program is suited best to those students who demonstrate fairly strong abilities in mathematics. By all accounts, the student body is very strong, attracting good students from across Canada and abroad."

A total of seven recommendations were provided by the reviewers, regarding student recruitment, faculty interaction with underrepresented and Directed Readings Program (DRP) students, engaging the community beyond math competitions, collaborative opportunities for students, and EDI considerations for space allocation and seminars. In response, the program created a plan outlining the specific actions proposed to address each recommendation as well as a timeline for implementation. The next cyclical review for this program is scheduled for 2029-2030.

Enrollment over the past three years

	General	Honours	Co-op	Grad
2025-2026 (CURRENT YR)	0	50	61	56
2024-2025 (LAST YR)	0	54	65	56
20XX-20XX (THREE YRS)	0	141	190	121

*Based on Active Student extract from Quest on December 1, 2025

Background

In accordance with the University of Waterloo's Institutional Quality Assurance Process (IQAP), this final assessment report provides a synthesis of the external evaluation and the internal response of the Pure Mathematics (BMath, Minor) programs delivered by the Department of Pure Mathematics. A self-study (Volume I, II, III) was submitted to the Associate Vice-President,

Academic on September 7, 2023. The self-study (Volume I) presented the program descriptions and learning outcomes, an analytical assessment of the programs, including the data collected from a student survey, along with the standard data package prepared by the Office of Institutional Analysis & Planning (IAP). The CVs for each faculty member with a key role in the delivery of the program(s) were included in Volume II of the self-study.

From Volume III, two arm's-length external reviewers were selected by the Associate Vice-President, Academic: Professor Douglas Farenick, Faculty of Science, University of Regina; and Professor Nantel Bergeron, Department of Mathematics and Statistics , York University.

Reviewers appraised the self-study documentation and conducted a site visit to the University on January 8-11, 2024. An internal reviewer from the University of Waterloo, Professor James Skidmore, Department of German and Slavic Studies, was selected to accompany the external reviewers. The visit included interviews with the Associate Vice-President, Academic; Dean of the Faculty of Mathematics; Faculty Associate Dean of Undergraduate Studies; Chair of the Department, as well as faculty members, staff and current undergraduate students. The Review Team also had an opportunity to meet with representatives from the library.

Following the site visit, the external reviewers submitted a report on their findings, with recommendations. Subsequently, the program responded to each recommendation and outlined a plan for implementation of the recommendations. Finally, the Dean responded to the external reviewers' recommendations, and endorsed the plans outlined by the program.

This final assessment report is based on information extracted, in many cases verbatim, from the self-study, the external reviewers' report, the program response and the Dean's response.

Program Characteristics

Pure Mathematics comprises a broad spectrum of mathematics. Interests of the Department include algebra, logic, number theory, analysis, geometry and topology, and range from the very classical to the most modern. Pure Math students take MATH courses in years one and two, and proceed to PMATH (Pure Math) courses in years three and four.

Details on programs and courses can be found in the Undergraduate Calendar:

Note that the Pure Math department jointly administers the Mathematical Finance plan with Actuarial Science. Mathematical Finance is not included with this review, as it is being reviewed elsewhere, so we will not mention it further.

Pure Mathematics programs focus on developing students' knowledge and understanding of fundamental areas of mathematics. Our students develop outstanding analytical and problem-

solving skills. They are trained to think logically, critically and creatively, and to write clear, rigorous arguments. Pure Mathematics also offers joint and minor plans for students both inside and outside the Faculty of Mathematics.

Summary of Strengths, Challenges and Weaknesses based on Self-Study

Strengths

- high academic quality of its students
- tremendous breadth of course offerings
- strong research profiles of faculty members in the department
- collegial atmosphere in the department, with excellent relations between faculty, staff, and students

Challenges and Weaknesses

- greater external funding would be a positive improvement
- less diversity overall with more students identifying as male

Summary of Key Findings from the External Reviewers

"Most universities in Canada do not have a stand-alone Faculty of Mathematics, and this gives the Department of Pure Mathematics some distinctive features in comparison to other mathematics departments in Canada. The first distinctive feature is that the Department of Pure Mathematics is not responsible for providing a wide range of course options, such as statistics or numerical analysis, and instead can concentrate entirely on the most theoretical parts of the mathematical sciences (e.g., logic, algebraic geometry, representation theory, etc.). The Department of Pure Mathematics is successful in providing a wide range of course options for students to choose from, perhaps more so than other universities of a similar size. However, it seems the pure mathematics program does have some gaps in coverage, with differential equations, probability theory, and advanced complex analysis as examples of topics that receive relatively less attention than they might in other mathematics programs in Canada.

The second distinctive feature is that the Department of Pure Mathematics is not responsible for the teaching of the ten core courses students take in their first and second years (as these courses are arranged by the Faculty), leaving the Department responsible for the third and fourth year courses. Members of the Department of Pure Mathematics do teach the core courses from time to time, but this appears to be a responsibility given to a subset of the research faculty. The Department's two lecturers do not have research expectations, and they contribute substantially to the teaching of the core courses; however they are also in the enviable position among lecturers in the Faculty of belonging to a department in which they have third or fourth year

courses as part of their regular teaching assignment, thus keeping them highly engaged in the discipline and exposing the third and fourth year students to instructors with strong teaching skills.

A third distinctive feature is the cooperative work-study program, in which more than half of the pure mathematics majors are registered. Some challenges to the co-op program include: (i) connecting industry employment skill sets with what is learned in pure mathematics courses; (ii) course sequencing; (iii) the frequency in which some courses are offered. The Department of Pure Mathematics has internal co-op employment opportunities by way of the NSERC USRA (Natural Sciences and Engineering Research Council of Canada's Undergraduate Student Research Award) and MURA (Mathematics Undergraduate Research Award) programs, which provide research experiences for undergraduate students."

External Reviewers' Recommendations and Program/Dean Reponses

1. **Student Recruitment:** Be more pro-active in recruiting USRA/MURA (Undergraduate Student Research Award/Mathematics Undergraduate Research Award) students by shoulder tapping potential candidates rather than expecting them to apply out of their own initiative.

   Program Response
   This is a good idea, and we will implement this for the USRA/MURA search for spring 2025, which is the next feasible opportunity. See section 5 for details for progress on this item.

   Dean's Response
   Our Mathematics Research Office has been making efforts to streamline the application process for USRA/MURA, partly to ensure students from underrepresented groups and/or groups less likely to be "tapped on the shoulder" are not disadvantaged in our allocation process. As such, it would be good to clarify how this recommendation interacts with these efforts before implementing it.

2. **Faculty Interaction with Underrepresented Students:** Create opportunities for pure mathematics faculty to interact with first- and second-year female and under-represented students.

   Program Response
   The Pure Mathematics department will work to ensure that our faculty members are connected with students from traditionally underrepresented groups at all levels, from first year through graduate study. Women in Mathematics is one organization in the Faculty that we can work with to help achieve this goal, and the Math Equity Office is another.

Dean's Response
This recommendation does intersect significantly with the work of our Women in Mathematics Committee so the response is appropriately connecting to existing resources.

3. **Faculty Interaction with DRP Students:** Continue to engage graduate students in the DRP (Directed Readings Program) and create opportunities for pure mathematics faculty to interact with DRP students, even though the majority of these students are not majoring in pure mathematics, by inviting those DRP involved in pure math projects to present their work to Department of Pure Mathematics faculty and students.

   Program Response
   The Pure Math department is committed to supporting the DRP, and we will continue to do so. In particular, the department chair will consult with the Women in Math (WiM) Director on the best way to increase contact between members of the Pure Math department and participants in the DRP.

   Dean's Response
   The Department of Pure Mathematics seems appropriately engaged in the Director Reading Program.

4. **Community Engagement Beyond Competitions:** Go beyond math competitions as a means for engaging the community by organizing an outreach program similar to the DRP in which high school students work in groups on interesting mathematical questions and give informal presentations.

   Program Response
   All of the components of this recommendation are already being implemented by the Centre for Education in Mathematics and Computing, so we feel that this recommendation has already been addressed. Nevertheless, we will continue to promote opportunities for Pure Mathematics students, postdoctoral scholars, and faculty members to participate in outreach and recruitment activities organized by the CEMC.

   Dean's Response
   We agree with the response: in our Faculty K-12 outreach is done by the CEMC. There is significant opportunity for feedback, collaboration and engagement between all Math departments and CEMC to ensure that interests are well represented.

5. **Student Collaboration Opportunities:** Encourage faculty members to work collaboratively when supervising undergraduate students, creating opportunities for students to work with a small group of peers instead of solely one-on-one with their supervising professors.

Program Response

This is already being done by some supervisors, although recent rule changes at the Faculty level might make this more difficult. However, we are engaged in an overhaul of the way USRA and MURA research experiences are organized, and we will consider this recommendation in that context. This overhaul will be complete by the end of the fall term of 2024. This was completed in fall 2024. An ad hoc committee was formed consisting of several of the department's most prolific supervisors of undergraduate research: Yu-Ru Liu (the WiM Chair), Wentang Kuo, Kevin Hare, Nico Spronk, and David McKinnon (department chair). The new process for hiring USRA and MURA students in Pure Math is more inclusive and equitable, and resulted in a much more diverse set of student applicants. The central features of this were a set of deadlines unified with the C&O department and a process by which students applied independently and faculty members hired students from their applications. The old process required students to find a faculty sponsor before applying, which many students found intimidating, including disproportionately many from traditionally underrepresented groups.

Unfortunately, we didn't anticipate that faculty members say "yes" more frequently to students who contact them directly compared to students who merely apply. This meant that we had dramatically fewer undergraduates hired to research positions last year than previously, and we had UG research positions go unused. We have responded to this by applying more pressure from the chair, but this has not yet corrected the whole problem.

In particular, this has made the idea of "tapping students on the shoulder to apply" (from item 1) is to some extent counter-productive, as we don't want to recruit students to a process only to be ignored by the faculty. After investigating best practices in other units, we have decided, effective July 1 2026, to appoint a faculty member as a Champion of the USRA/MURA program, tasked with connecting as many students as they can with research opportunities. In particular, this should enable us to more easily identify and promote students from traditionally underrepresented groups. Combined with our existing practices of promoting the USRA/MURA programs in our core courses and encouraging strong students to apply, we are optimistic that we will see significant progress.

Dean's Response

Pure Math has received generous funding for USRA and MURA and we hope they can maximize the impact of these funds. Any potential issues around rule-changes have been clarified.

6. **EDI Considerations for Space Allocation:** Reconsider how space is assigned to USRA/MURA students by creating welcoming office and study spaces for women and keeping equity and diversity considerations in mind when assigning spaces to undergraduate students.

   Program Response
   As noted above, the department is planning to engage in a review of its USRA/MURA practices, and space considerations, especially viewed through an EDI lens, fit perfectly into the purview of that review. However, new space constraints make it unlikely that we will be able to continue to offer any kind of space to undergraduate researchers, making this recommendation tragically moot. Before these new constraints, the department assigned undergraduate researchers to one large space, to encourage collaboration and a sense of community. The department feels that this strategy worked very well, and we are disappointed that we will likely not be able to continue it. Should the department acquire new space resources, we will likely return to that space strategy for undergraduate researchers.

   Dean's Response
   The Faculty is indeed facing a space crunch for the next 2-3 years due to the Mathematics 4 construction, which requires us to vacate part of the Davis Centre building. Once this is completed, we will have more space to allocate and will be able to consider different requests such as the one mentioned in this recommendation.

7. **EDI Considerations for Seminars:** Take steps to ensure seminars are run in a manner in which women and under-represented students feel they belong and are valued (in this regard, it may be useful for all seminar leaders to take formal training on what constitutes a welcoming, inclusive environment).

   Program Response
   The Pure Math department is committed to making all people – regardless of gender, ethnicity, sexuality, or culture – to feel welcome and valued. We will conduct a thoroughgoing review of our practices in running seminars in order to ensure that everyone feels welcomed and included. This will include soliciting feedback from students, postdoctoral scholars, and faculty members about how they feel in seminars and colloquia.

   Dean's Response
   Such concerns are considered very carefully within the Faculty of Math. We encourage the chair to work with the Math Director of Equity and Women in Math to consider more carefully this feedback.

Recommendations Not Selected for Implementation

N/A

Implementation Plan

	Recommendations	Proposed Actions	Responsibility for Leading and Resourcing (if applicable) the Actions	Timeline for addressing Recommendations
1.	**Student Recruitment**	We will review our USRA/MURA practices and investigate the feasibility of this recommendation as part of that review.	Department chair	Two years (2026)
2.	**Faculty Interaction with Underrepresented Students**	We will investigate how to implement this recommendation beyond what we already do.	Department chair	Two years (2026)
3.	**Faculty Interaction with DRP Students**	We will continue to support the DRP and its participants, especially those connected with the Pure Math department.	Department chair	Ongoing
4.	**Community Engagement Beyond Competitions**	This recommendation has already been satisfied by the CEMC's activities.	N/A	Already done
5.	**Student Collaboration Opportunities**	We will review our USRA/MURA practices and investigate the feasibility of this recommendation as part of that review.	Department chair	Two years (2026)
6.	**EDI Considerations for Space Allocation**	We will review our USRA/MURA practices and investigate the feasibility of this recommendation as part of that review.	Department chair	Two years (2026)
7.	**EDI Considerations for Seminars**	We believe that our seminars are already inclusive of women and students from traditionally underrepresented groups, but we will continue to work on improvements.	Department chair	Ongoing

The Department Chair/Director, in consultation with the Dean of the Faculty shall be responsible for the Implementation Plan.

Date of next program review **2029-2030**

Date

Signatures of Approval

Please keep this document in Word version. We do require you to sign it or demonstrate your approval. If you have issues with signing a Word document, please confirm your approval by adding the following wording when you send back the document by email "I hereby approve the attached document." We will collect formal signatures at a later stage on a pdf version.

November 3, 2025

Chair/Director Date

AFIW Administrative Dean/Head (*For AFIW programs only*) Date

Faculty Dean Date

Note: AFIW programs fall under the Faculty of ARTS; however, the Dean does not have fiscal control nor authority over staffing and administration of the program.

Oct.14, 2025

Associate Vice-President, Academic Date
(For undergraduate and augmented programs)


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