

September 4, 2009

Vice Chancellor Beth Rushing  
University of Washington, Tacoma  
Box 358430

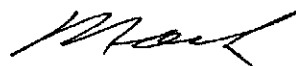
Dear Beth:

Based upon the recommendations of the Faculty Council on Academic Policy, the Faculty Council on Tri-Campus Policy has recommended approval of a minor in Mathematics. A copy of the proposal is attached.

I am writing to inform you that the Interdisciplinary Arts and Sciences program is authorized to specify these requirements beginning autumn quarter 2009 and thereafter.

The new requirements should be incorporated in printed statements and in individual department websites as soon as possible. The *General Catalog* website will be updated accordingly by the Registrar's Office.

Sincerely yours,



Mark A. Emmert  
President

Enclosure

cc: Dr. Larry Knopp (with enclosure)  
Mr. Robert Corbett (with enclosure)  
Dr. Deborah H. Wiegand (with enclosure)  
Mr. Todd Mildon, J.D. (with enclosure TQS-20090327)



UNIVERSITY OF WASHINGTON  
**CREATING AND CHANGING UNDERGRADUATE  
 ACADEMIC PROGRAMS**

OFFICE USE ONLY  
 Control #  
 TQS-20090327

After college/school/campus review, send a signed original and 8 copies to the Curriculum Office/FCAS, Box 355850.  
 For information about when and how to use this form: <http://depts.washington.edu/uwcr/1503instructions.pdf>

<b>College/Campus</b> UW Tacoma	<b>Department/Unit</b> Interdisciplinary Arts and Sciences	<b>Date</b> March 27, 2009
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**New Programs**

- Leading to a Bachelor of \_\_\_\_\_ in \_\_\_\_\_ degree.
- Leading to a Bachelor of \_\_\_\_\_ degree with a major in \_\_\_\_\_.
- Leading to a \_\_\_\_\_ Option within the existing major in \_\_\_\_\_.
- Leading to a minor in Mathematics

**Changes to Existing Programs**

- New Admission Requirements for the Major in \_\_\_\_\_ within the Bachelor of \_\_\_\_\_.
- Revised Admission Requirements for the Major in \_\_\_\_\_ within the Bachelor of \_\_\_\_\_.
- Revised Program Requirements for the Major in \_\_\_\_\_ within the Bachelor of \_\_\_\_\_.
- Revised Requirements for the Option in \_\_\_\_\_ within the major in \_\_\_\_\_.
- Revised Requirements for the Minor in \_\_\_\_\_.

**Other Changes**

- Change name of program from \_\_\_\_\_ to \_\_\_\_\_.
- New or Revised Continuation Policy for \_\_\_\_\_.
- Eliminate program in \_\_\_\_\_.

Proposed Effective Date: **Quarter:**  Autumn  Winter  Spring  Summer **Year: 20 09**

Contact Person: Cheryl Greengrove <i>Cheryl Knoff</i>	Phone: 692-4455	Email: cgreen@u.washington.edu	Box: 358436
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**EXPLANATION OF AND RATIONALE FOR PROPOSED CHANGE**

For new program, please include any relevant supporting documentation such as student learning outcomes, projected enrollments, letters of support and departmental handouts. (Use additional pages if necessary).

The need for improved access to mathematics education for all citizens is eloquently presented in the executive summary of FOUNDATIONS FOR SUCCESS: THE FINAL REPORT OF THE NATIONAL MATHEMATICS ADVISORY PANEL (2008).

"The eminence, safety, and well-being of nations have been entwined for centuries with the ability of their people to deal with sophisticated quantitative ideas. Leading societies have commanded mathematical skills that have brought them advantages in medicine and health, in technology and commerce, in navigation and exploration, in defense and finance, and in the ability to understand past failures and to forecast future developments... There are consequences to a weakening of American independence and leadership in mathematics, the natural sciences, and engineering. We risk our ability to adapt to change. We risk technological surprise to our economic viability and to the foundations of our country's security... The national workforce of future years will surely have to handle quantitative concepts more fully and more deftly than at present. So will the citizens and policy leaders who deal with the public interest in positions of civic leadership. Sound education in mathematics across the population is a national interest."

A mathematics minor allows UWT students to strengthen their facility with quantitative analysis in their chosen discipline, helping to create a more numerate citizenry. Not offering such an opportunity would be antithetical to Governor Gregoire's "Washington Learns" initiative calling for more science/math education and career pathways for students.

Current mathematics offerings at UWT support science, technology, and business students across campus. With a few well-selected upper-division courses, these students can complete mathematics minors and thereby document their analytical strengths to prospective employers.

Additionally, by providing greater mathematical content in student-centered, active learning environments, we can support prospective and in-service mathematics teachers. The UWT Education department is currently developing a secondary mathematics endorsement. Native mathematics minors may increase demand for this line of engagement. The focus of the endorsement is methodology, pedagogy, theory and practice. The necessary mathematical context is expected to be mastered before enrolling. By improving our mathematics offerings, we will assist those preservice teachers in need of further mathematical studies, making the proposed endorsement a more attractive option.

The objectives of the mathematics minor are to strengthen student facility with quantitative analysis in their chosen discipline and to increase offerings that provide necessary content for future teachers. Graduates will continue to pursue careers in teaching, finance, science, engineering, and professional fields such as law and medicine with stronger documentation of their analytical abilities.

Educational outcomes: The study of mathematics emphasizes exposure to the core foundational areas of analysis, modern algebra, and geometry. A mathematician's skill set includes the technical tools specific to each area as well as the development of critical thinking skills necessary for logical reasoning. A student completing a minor in mathematics should be able to

- Demonstrate mathematical skill with basic computational tools and methods
- Use analytical reasoning to organize and write strong arguments
- Demonstrate understanding of at least one foundational area of mathematics
- Apply mathematical theory to another discipline

See attached proposal for additional details.

**OTHER DEPARTMENTS AFFECTED**

List all departments/units/ or co-accredited programs affected by your new program or changes to your existing program and acquire the signature of the chair/director of each department/unit listed. Attach additional page(s) if necessary. \*See online instructions.

Department/Unit:	Chair/Program Director:	Date:
Department/Unit:	Chair/Program Director	Date:

**CATALOG COPY**

Catalog Copy as currently written. Include only sections/paragraphs that would be changed if your request is approved. Please cross out or otherwise highlight any deletions.

N/A

**PROPOSED CATALOG COPY**

Reflecting requested changes (Include exact wording as you wish it to be shown in the printed catalog. Please underline or otherwise highlight any additions. If needed, attach a separate, expanded version of the changes that might appear in department publications).  
**Please note:** all copy will be edited to reflect uniform style in the General Catalog.

**Minor in Mathematics**

Mathematics contributes technical tools for precise reasoning and communication. Mathematics study provides a paradigm of critical thinking: identifying and questioning premises, inferring patterns from evidence, deducing conclusions from hypotheses, and expressing ideas clearly—all benefiting the diverse needs of students pursuing undergraduate studies in science, social science, technology, business, education, and the liberal arts.

**Requirements**

The Mathematics minor requires 33 credits to include:

- Required Courses (21 credits)

TQS 124: Calculus with Analytic Geometry I (5)

TQS 125: Calculus with Analytic Geometry II (5)

TQS 126: Calculus with Analytic Geometry III (5)

TQS 307: Introduction to Differential Equations (3)

TQS 308: Matrix Algebra with Applications (3)

- Twelve additional units of 300-level course work or above
- At least 22 units in mathematics taken at UWT or through college transfer (not AP) credit.
- At least 9 credits of courses numbered 301 or higher taken in residence at the UWT. Minimum grade of 2.0 required for each course offered as part of the minor.

The elective courses will be selected from

- Courses currently offered across campus:

TQS 390 Probability and Statistics in Engineering and Science (4)

TCSS 321 Discrete Structures I (5)

TCSS 343 Design and Analysis of Algorithms (5)


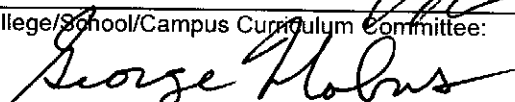


~~T BUS 301 Quantitative Analysis for Business (5)~~

TESC 422 Environmental Modeling (6)

TQS 490 Special Topics in Quantitative Studies (1-7)

Should be TESC  
430

**APPROVALS**

Chair/Program Director:		Date:	5/20/09
College/School/Campus Curriculum Committee:		Date:	6/03/09
Dean/Vice Chancellor:		Date:	5/26/09
Faculty Council on Academic Standards/ General Faculty Organization/Faculty Assembly Chair:		Date:	08/05/09
<b>POST TRI-CAMPUS APPROVAL (when needed)</b>			
Faculty Council on Academic Standards/ General Faculty Organization/Faculty Assembly Chair:		Date:	

# Proposal for Minor in Mathematics

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*Interdisciplinary Arts and Sciences  
University of Washington Tacoma*

## **Objectives of Minor**

- To strengthen student facility with quantitative analysis in their chosen discipline
- To increase offerings that provide necessary content for future teachers

## **Course Requirements**

The Mathematics minor requires 33 credits, 21 credits in 5 required classes (TQS 124-125-126, TQS 307, TQS 308) and 12 credits in 3-4 additional electives at the 300-level or above. Electives may come from outside of TQS (possibilities exist in TBUS, TCSS, TESC and are being developed in TESC, TEDUC).

## **Educational Objectives** *(What students will do after graduation)*

Graduates will continue to pursue careers in teaching, finance, science, engineering, and professional fields such as law and medicine with stronger documentation of their analytical abilities.

## **Educational Outcomes** *(What students should be able to do at time of graduation)*

The study of mathematics emphasizes exposure to the core foundational areas of analysis, modern algebra, and geometry. A mathematician's skill set includes the technical tools specific to each area as well as the development of critical thinking skills necessary for logical reasoning. A student completing a minor in mathematics should be able to

- Demonstrate mathematical skill with basic computational tools and methods
- Use analytical reasoning to organize and write strong arguments
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## **Required University Documentation**

### **Explanation and Rationale for Proposed Minor in Mathematics (part of UW 1503 form)**

The need for improved access to mathematics education for all citizens is eloquently presented in the executive summary of **FOUNDATIONS FOR SUCCESS: THE FINAL REPORT OF THE NATIONAL MATHEMATICS ADVISORY PANEL (2008)**.

*The eminence, safety, and well-being of nations have been entwined for centuries with the ability of their people to deal with sophisticated quantitative ideas. Leading societies have commanded mathematical skills that have brought them advantages in medicine and health, in technology and commerce, in navigation and exploration, in defense and finance, and in the ability to understand past failures and to forecast future developments...There are consequences to a weakening of American independence and leadership in mathematics, the natural sciences, and engineering. We risk our ability to adapt to change. We risk technological surprise to our economic viability and to the foundations of our country's security...The national workforce of future years will surely have to handle quantitative concepts more fully and more deftly than at present. So will the citizens and policy leaders who deal with the public interest in positions of civic leadership. Sound education in mathematics across the population is a national interest.*

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### **Proposed Catalog Copy (Part of UW 1503 form)**

Mathematics contributes technical tools for precise reasoning and communication. Mathematics study provides a paradigm of critical thinking: identifying and questioning premises, inferring patterns from evidence, deducing conclusions from hypotheses, and expressing ideas clearly—all benefiting the

**Tacoma: Minor in Mathematics (TQS-20090327)**

**Overall response: There is strong support for a Mathematics Minor on the Tacoma campus. The few issues that arose in the comments will be addressed below in bold.**

Tri-Campus Review Comments:

PAUL T ALLEN

This is a much-needed addition to the UWT offerings. My current students wish they could earn this minor.

LOVEDAY L CONQUEST

A solid math minor curriculum. This will certainly strengthen the quantitative skills of UWT graduates.

SHARON PARKER

A mathematics minor is very important for UWT and I support it. However, I would be pleased to know that faculty include some attention to cultural diversity in the required courses. For example, Calculus with Analytic Geometry could reference the early history of Geometry among the Incas and Mayas and North American tribes, such as the geometric Hopewellian earthworks construction at High Bank in Ohio; or Special Topics for Quantitative Studies could encourage students to undertake research projects that involve issues peculiar to distinct populations, such as educational attainment of Native American or African American students. The more this and other STEM fields are treated as though they have no history, application or relevance to the lives of people of color, the more it will be believed.

Sharon Parker

Assistant Chancellor for Equity & Diversity

UWT

**Response: The required courses in mathematics have standard content and expected competencies. There is a constant battle as to how to achieve the stated goals of the course. Introducing cultural components, integrating writing, focusing on active learning, are all admirable endeavors for a mathematics course. However, their use is best left to the discretion of the instructor—especially in the initial courses like Calculus whose content forms the foundation for future study in a myriad of STEM fields.**

**That being said, to be an effective minor we are proposing several new electives, including the History of Mathematics. While not every student will have the opportunity to take this course, it would be one place where cultural diversity can be addressed. Please note, the examples given by Dr. Parker above would be appropriate for a discussion in Geometry, which is very different than Analytic Geometry.**

DONALD D. CHINN

I am in support of the mathematics minor. A few notes on the electives.

TCSS 321 (Discrete Structures) and TCSS 343 (Design and Analysis of Algorithms) are listed as potential electives. These are required courses for the BS in CSS in the Institute. For the BA, just 321 is required.

The prerequisites for TCSS 321 are TCSS 142 and 143 (or equivalent). The prerequisites for TCSS 343 are TCSS 342 (which requires TCSS 321 and TCSS 305) and TCSS 322 (which requires TCSS 321). So, unless there is a radical restructuring of the CSS prerequisite structure, TCSS 321 and TCSS 343 will unlikely to be chosen as electives by students who opt for the mathematics major and are not in the CSS program. If the intent is that only CSS students would take TCSS 321 and 343 to satisfy the math minor requirement, then that makes sense to me.

I'd also like to comment on Sharon Parker's comment above. I think including cultural components, including diversity, into these courses (indeed, all courses at the university) is a good idea. However, in the case of first-year calculus, I believe there is plenty of material to cover, given the demands of the courses "downstream" that depend on it. I think for this mathematics minor, the electives are the best place to discuss issues of cultural diversity, as the students are more mature -- intellectually and otherwise -- by the time they have taken their major core courses and also they have a base set of knowledge to which they can compare, contrast, and ultimately appreciate the contributions of people of color. I think this would especially benefit pre-service teachers. Some ideas to fulfill this vision: (1) require (or suggest strongly) that one of the criteria used for eligibility of a course to be an elective for the math minor is that it includes one or more learning units that address cultural diversity, (2) specifically design new courses that include and heavily integrate such components. Perhaps this could be a model for all minor programs for including cultural diversity, not just the mathematics minor.

**Response: TCSS 321 and TCSS 343 contain sufficient mathematical content that they should be considered upper division mathematics electives for the minor. There is no doubt that the students utilizing these courses for the minor will likely come from the CSS program. I have been in discussion with the Institute faculty about broadening the prerequisite for TCSS 321 to allow students with 2 quarters of Calculus (but no programming) to enroll.**

**The intent is not to cobble together an unrealistic minor from courses that already exist. To be a coherent program capable of serving future scientists and teachers, we need to add the electives in Number Theory, Algebra, Real Analysis, and History at a minimum. However, students in the CSS program could complete a mathematics minor that complements their current course of study using courses that exist in the curriculum and should be allowed to do so.**



**UNIVERSITY CAMPUSES UNDERGRADUATE PROGRAM REVIEW PROCEDURES\*\***

**CHECKLIST**

Title of Proposal: Minor in Mathematics

Proposed by (unit name): Interdisciplinary Arts and Sciences

Originating Campus:

UW, Seattle

UW, Bothell

UW, Tacoma

**I. Phase I. Developed Proposal Review** (to be completed by Originating Campus' Academic Program Review body)

A. Review Completed by: (list name of program review body)

Chaired by:

06/03/09 Date proposal received by originating campus's review body

06/12/09 Date proposal sent to University Registrar

06/12/09 Date proposal posted & email sent to standard notification list

08/05/09 Date of originating campus's curriculum body approval

(Note: this date must be 15 business days or more following date of posting)

B. 4 Number of comments received. Attach the comments and a summary of the consideration and responses thereof: (1-2 paragraphs)

**II. Phase II. Final Proposal Review** (to be completed by FCTCP)

A. Review Completed by:

FCTCP subcommittee

FCTCP full council

Chaired by: Janet Primomo, UW Tacoma

8/11/09// Date request for review received from University Registrar

8/21/09// Date of FCTCP report

B. Review (attached)

YES NO

- \_\_\_ Was notice of proposal posted on UW Website for 15 business days?
- \_\_\_ Was notice of proposal sent to standard mailing list 15 business days in advance of academic program review?
- \_\_\_ Were comments received by academic program review body?
- \_\_\_ Was response to comments appropriate? (explain, if necessary)
- \_\_\_ Was final proposal reviewed by FCTCP within 14 days of receipt?
- \_\_\_ Was there adherence to the University Campuses Undergraduate Program Review Process? (explain, if necessary)

C. Recommendation

The FCTCP Program Review Sub-committee reviewed the proposal for a mathematics minor at UWT and find that the appropriate process was followed. There were 4 comments that were all supportive of the proposal. Two comments included suggestions for enhancing the curriculum proposed. In one case, the suggestion of adding an historical perspective on mathematics to attract interest from persons of color was acknowledged. Such a course will be offered as an elective. In another case, a suggestion from someone in the CSS department was similarly acknowledged and addressed. We recommend the proposal move to the next phase of approval.

**Summary :**

- \_\_\_ Forward for final approval
- \_\_\_ Forward to Provost because of University issues (Explain)
- \_\_\_ Return to campus council because of insufficient review (Explain).

\*\*Endorsed by Faculty Senate Executive Committee, 1/10/05, modified 1/31/06; These procedures apply to new undergraduate degrees, majors, minors (and certificates) and substantive changes to same