



EPC PROPOSAL FORM

Originating Academic Unit:	Mathematics
Date Proposal Submitted:	October 15, 2021 (revised final)

INSTRUCTIONS: Upon completing the form, submit a hard copy with all appropriate signatures to the Office of the Provost. In addition, email a copy to EPC via the Faculty Governance Manager (facgov@plu.edu).

DEADLINES: Type 1 proposals, being non-substantive, are generally considered on a rolling basis. Type 2 proposals - December 1. Type 3 proposals - October 1.

For specifics on the processing of each type of proposal, see '2. Flowchart of Usual Procedure for Curriculum Revision' and '5. Checklist for Developing Proposals' in the EPC Manual, found in the [Faculty Handbook](#) (Section III, Part VI).

PROPOSAL SUMMARY

Provide a summary of the proposal.

The Mathematics Department proposes the creation of a BS in Applied Mathematics. This major will consist of existing courses in the Mathematics and other departments, with the exception of the addition of a permanent 4-credit Mathematical Modeling course, which will be offered once annually.

The major will be geared toward students interested in careers in the industry, which require applied backgrounds and skills; and towards students planning on going to graduate school in Applied Mathematics, Statistics or Data Science.

TYPE OF PROPOSAL

Check all the appropriate boxes.

TYPE 1: NON-SUBSTANTIVE CHANGES *[complete shaded sections and provide signatures]*

Check boxes in this section. Also complete Proposal Summary (above), Catalog/Curriculum Changes section (ahead), and provide chair/dean signatures on final page.

- Change course number
- Change course title
- Delete course with no GenEd element, which is not part of by any other major/minor/concentration
- Prerequisite change within the academic unit only
- Catalog correction (editorial)

TYPE 2: SUBSTANTIVE CHANGES *[complete all sections, including signatures]*

Submit completed form, including signatures. Be sure to check all boxes that apply.

- Change catalog description⁺⁺
- Add permanent GenEd course⁺⁺
- Add permanent non-GenEd course⁺⁺
- Change a course's credit hours
- Add GenEd Element to existing course⁺⁺
- Delete GenEd course

department about their new biostatistics course. It is our desire to incorporate that course (once it becomes permanent) into the proposed major so as to create a biostatistics emphasis option. That option would be in addition to the other emphases already included. To allow students to complete this major along with another one, and in accord with boundary-crossing that already exists in the natural sciences, students will be allowed to double-count up to 8 credits of coursework at the 300+ level for other major requirements.

The BS in Applied Mathematics has the following learning outcomes:

- Communication: Be able to read, interpret, write about, and talk about mathematics.
- Computation: Develop computational, algorithmic, and technological problem-solving fluency.
- Application: Be able to apply mathematical concepts to concrete situations.
- Disciplinary Citizenship: Develop collaborative skills, independence, perseverance; and have experience with open-ended inquiry.

CATALOG/CURRICULUM CHANGES

Current Catalog Language:

Bachelor of Science Degree

Major in Mathematics

36-40 semester hours of mathematics, plus 8 to 13 semester hours of supporting courses

- 32 semester hours of required mathematics courses: MATH 152, 242, 253, 317 or 318 or 319, 331, 433, 455, 499A, 499B
- 8 additional semester hours of electives from MATH 317, 318, 319*, 342, 348, 351**, 356, 381, 480, or PHYS 354

(At most, one of MATH 317, 318, and 319, not already used in the bullet points above, can be used toward the 8 additional semester hours of electives needed.*

***Only one course from either MATH 351 or PHYS 354 may be used.)*

- 8 or 9 semester hours of supporting courses: CSCI 144 and one course from: CSCI 371 or PHYS 153/163 Lab

Proposed Catalog Language: (note changes in **Blue Bold** and ~~Blue Strikeout~~)

Bachelor of Science Degree

Major in Mathematics

36-40 semester hours of mathematics, plus 8 to 13 semester hours of supporting courses

- 32 semester hours of required mathematics courses: MATH 152, 242, 253, 317 or 318 or 319, 331, 433, 455, 499A, 499B
- 8 additional semester hours of electives from MATH 317, 318, 319*, 342, 348, 351**, 356, 381, **422**, 480, or PHYS 354

(At most, one of MATH 317, 318, and 319, not already used in the bullet points above, can be used toward the 8 additional semester hours of electives needed.*

***Only one course from either MATH 351 or PHYS 354 may be used.)*

- 8 or 9 semester hours of supporting courses: CSCI 144 and one course from: CSCI 371 or PHYS 153/163 Lab

Major in Applied Mathematics

36-40 semester hours of mathematics/statistics, plus 8 to 13 semester hours of supporting courses

- 24 semester hours of required mathematics courses: MATH 152, 253, 318, 331, **422**, 499A, 499B
- 4 semester hours of statistics from MATH/STAT 145, STAT 231, or MATH/STAT 242.
- 12 semester hours of electives from MATH/STAT 342, MATH/STAT 348, either MATH 351 or PHYS 354, MATH 356, either MATH 433 or MATH 455, CSCI 330, CSCI 367, CSCI 371, CHEM 341, ECON 344, PHYS 356. At least 8 semester hours of these must be taken from mathematics or statistics.
- 4 or 5 semester hours of supporting courses from: CHEM 115, CSCI 270, ECON 101, or PHYS 153/163 Lab
- 4 semester hours from CSCI 144 or DATA 133 (MATH 356 or another approved 300-level or 400-level mathematics course may be substituted for this requirement if a student is completing the Data Science minor.)

A maximum of eight (8) credits at the 300+ level may be double-counted for other major requirements, and a maximum of eight (8) credits may be double-counted for other minor requirements. (Petitions to substitute courses may be submitted to the department chair to address double-counting constraints.) Students minoring in statistics may not use any of their “8 additional semester hours of statistics” toward the Applied Mathematics major.

MATH 422: Mathematical Modeling

This course introduces students to mathematical modeling of various problems in biology, environmental science and physics using curve fitting, difference and differential equations, simulations, discrete probabilistic models, and other methods. In addition to mathematical techniques, the formulation and analysis of models, and the interpretation of mathematical results in context are also emphasized. Students will have a chance to work on a project of their choosing and to build writing skills. Prerequisites: Math 245 or Math 253, and one of Math 331, Math 351 or PHYS 354.

Additional information for courses:

Is this a course that because of variable content could be repeated for credit?	<input type="checkbox"/>	Yes,	<input type="checkbox"/>	?	Times [If yes, the parameters must be clear in course description]	<input checked="" type="checkbox"/>	No [Default is 'no.' Note that does not exclude a student's option to repeat a course for a better grade to replace the initial one.]
Grade Type:	<input checked="" type="checkbox"/>	Standard Letter	<input type="checkbox"/>	Pass/Fail			
Anticipated Enrollment:							
Course Syllabus Attached**:	<input checked="" type="checkbox"/>	Yes	<input type="checkbox"/>	No			

**Required for new courses, and other proposals as indicated above.

Does the proposal include the addition to a course of one or more General Education Program elements (GenEd)?

Yes (Check the appropriate boxes below)

If more than one course is proposed, make sure the proposal makes clear which GenEd elements, if any, are proposed for each course.

No

- | | |
|---|--|
| <input type="checkbox"/> Alternative Perspectives A | <input type="checkbox"/> Physical Activity PE |
| <input type="checkbox"/> Art, Music, Theatre AR | <input type="checkbox"/> Philosophy PH |
| <input type="checkbox"/> Cross Cultural Perspective C | <input type="checkbox"/> Religion: Christian Traditions RC |
| <input type="checkbox"/> International Honors (100-level) H1 | <input type="checkbox"/> Religion: Global Religious Traditions RG |
| <input type="checkbox"/> International Honors (200-level) H2 | <input type="checkbox"/> Science and Scientific Method SM |
| <input type="checkbox"/> International Honors (300-level) H3 | <input type="checkbox"/> Investigating Human Behavior, Culture, and Institutions SO |
| <input type="checkbox"/> Literature LT | <input type="checkbox"/> Senior Seminar/Project SR |
| <input type="checkbox"/> Inquiry Seminar (FYEP) F | <input type="checkbox"/> Writing Seminar (FYEP) FW |
| <input type="checkbox"/> Mathematical Reasoning MR | |
| <input type="checkbox"/> Natural Sciences, Mathematics, or Computer Science NS | |

NOTE: Submissions will be forwarded to the Core Curriculum Committee for its review and recommendation.

Diversity courses have specific learning objectives that must be included in the syllabus.

STAFFING & BUDGETARY IMPLICATIONS

Has this proposal been formally approved by at least 2/3 of the full-time teaching faculty in your academic unit?

Yes

No (Indicate why the proposal is being forwarded to EPC)

Does this proposal impact any other academic unit?

Yes (List below and indicate if 2/3 of the full-time faculty in that area support the proposal)

Chemistry, Computer science, Economics, Physics

No

Does this proposal require the commitment of new or substantially different support services (e.g., Library acquisitions, Information and Technology Services, Wang Center)?

Yes (Explain and indicate if support services have been consulted)

No

Explain how the proposed change(s) will be staffed. Revised 2-Year Course Cycle must be attached.

As explained above, there are no staffing changes. A 2-Year Course Cycle is attached.

Are special budgetary arrangements and funding required? If “no”, explain how the proposed changes will be integrated without added personnel or budgetary requirements.

Yes (Explain what types of support will be used to meet the budgetary requirements of the proposed change(s). Include the source(s) of funding, percentage of costs covered, and time frame covered.)

No

Reductions were made in other course offerings in order to allow us to offer a 4-credit MATH 422 course.

NOTE: Budgetary considerations will be reviewed/approved by Dean and Provost.

REQUIRED SIGNATURES

Department Chair/Program Chair/Associate Dean (Date)


Dean (Date)

Provost (Date)

- Forwarded with Endorsement
- Forwarded with Reservations

REQUIRED SIGNATURES

 9/23/21
Department Chair/Program Chair/Associate Dean (Date)

 9/23/2021
Dean (Date)

Forwarded with Endorsement

Provost

(Date)

Forwarded with Reservations



Carol Bautista <bautisca@plu.edu>

EPC--MATH AddPermNonGenEdCrSCreateNewMajorAppliedMath Type 2 and 3

Joanna Gregson <gregsojg@plu.edu>

Mon, Oct 4, 2021 at 8:57 AM

To: Carol Bautista <bautisca@plu.edu>

Forwarded with endorsement.

Joanna

[Quoted text hidden]

--

Joanna Gregson, Ph.D.
Provost and Senior Vice President for Academic Affairs
Professor of Sociology
Pacific Lutheran University
Tacoma, WA 98447



Carol Bautista <bautisca@plu.edu>

another minor change to the Applied Math major EPC

Karen Travis <traviskm@plu.edu>

Wed, Sep 22, 2021 at 11:23 AM

To: Jessica Sklar <sklarjk@plu.edu>

Cc: Bret Underwood <bret.underwood@plu.edu>, Andrea Munro <munroam@plu.edu>, David Wolff <wolffda@plu.edu>, Carol Bautista <bautisca@plu.edu>, Ann Auman <aumanaj@plu.edu>, Tom Edgar <edgartj@plu.edu>

Hi Jess

Economics approves this request, and I apologize for the late notice on the ECON electives here. So many moving parts as we are working to update our department stuff in high speed too.

We appreciate being included in this proposal.

Thanks,

Karen

[Quoted text hidden]

--

Karen M. Travis (she/her/hers)
Professor and Chair of Economics
Pacific Lutheran University



Carol Bautista <bautisca@plu.edu>

another minor change to the Applied Math major EPC

Bret Underwood <underwbj@plu.edu>

Wed, Sep 22, 2021 at 11:30 AM

Reply-To: bret.underwood@plu.edu

To: Jessica Sklar <sklarjk@plu.edu>

Cc: Bret Underwood <bret.underwood@plu.edu>, Karen Travis <traviskm@plu.edu>, Andrea Munro <munroam@plu.edu>, David Wolff <wolffda@plu.edu>, Carol Bautista <bautisca@plu.edu>, Ann Auman <aumanaj@plu.edu>, Tom Edgar <edgartj@plu.edu>

Hi Jess,

Thanks for the update - Physics is happy to approve this.

Best,

-Bret

--

Dr. Bret Underwood
Associate Professor of Physics
Chair, Department of Physics
Pacific Lutheran University
bret.underwood@plu.edu

On Wed, Sep 22, 2021 at 11:14 AM Jessica Sklar <sklarjk@plu.edu> wrote:

[Quoted text hidden]



Carol Bautista <bautisca@plu.edu>

another minor change to the Applied Math major EPC

David Wolff <wolffda@plu.edu>

Wed, Sep 22, 2021 at 2:53 PM

To: Bret Underwood <bret.underwood@plu.edu>

Cc: Jessica Sklar <sklarjk@plu.edu>, Karen Travis <traviskm@plu.edu>, Andrea Munro <munroam@plu.edu>, Carol Bautista <bautisca@plu.edu>, Ann Auman <aumanaj@plu.edu>, Tom Edgar <edgartj@plu.edu>

Hi Jess,

The Computer Science department approves this proposal.

Thanks,
David

[Quoted text hidden]



Carol Bautista <bautisca@plu.edu>

another minor change to the Applied Math major EPC

Andrea Munro <munroam@plu.edu>

Thu, Sep 23, 2021 at 9:12 AM

To: Jessica Sklar <sklarjk@plu.edu>

Cc: Bret Underwood <bret.underwood@plu.edu>, Karen Travis <traviskm@plu.edu>, David Wolff <wolffda@plu.edu>, Carol Bautista <bautisca@plu.edu>, Ann Auman <aumanaj@plu.edu>, Tom Edgar <edgartj@plu.edu>

Chemistry approves this proposal.

Best,
Andrea

On Wed, Sep 22, 2021 at 11:14 AM Jessica Sklar <sklarjk@plu.edu> wrote:
[Quoted text hidden]

--
Andrea M. Munro, Ph.D.
Chair of the [Chemistry Department](#) and [STEM Education minor](#)
Associate Professor of Chemistry
Pacific Lutheran University
Tacoma, WA 98447
pronouns: she/her/hers
[Schedule a student appointment](#): M & W 1-2 pm, T 10-11, F 9:30-10:30
[Culturally sustaining STEM \(CS-STEM\) teacher program at PLU](#)

Institutional Impact Evaluation Form

- 1. Name of Proposed Program:** Bachelor of Science in Applied Mathematics
- 2. Executive Summary:** In 1-2 paragraphs, describe the proposed program, including a clear statement of how the program meets the mission of the university.

The BS in Applied Mathematics is an interdisciplinary major that builds on existing courses in Mathematics and other departments and adds a permanent mathematical modeling course to provide our majors with a stronger preparation in applied mathematics and statistics, which will make them more successful in careers in industry as well as graduate programs in statistics and data science.

The study of mathematics in general provides students with quantitative tools necessary for *thoughtful inquiry* and for making sense of the world. Applied mathematics and statistics additionally investigate contexts related to *caring for others, our communities and the earth*; climate change, the spread of infectious diseases, racial profiling, and a multitude of other contexts. Studying these contexts and gaining applied mathematical and statistical skills in the major will allow students to apply their new knowledge in a thoughtful, ethical, and informed manner in their future work. Due to our ability to provide our students with individualized care and attention, we will also be able to provide opportunities to majors to *advance their knowledge through collaborations with faculty*, and in doing so, *test their assumptions* about mathematics and its impact on the world.

While the Mathematics Department has long identified application as one of its essential learning objectives, we have found that this objective has not been explicitly present in any of the core courses for the BS and BA in Mathematics or the BS in Mathematics Education. The core courses for the BS in Applied Mathematics include applications-rich courses that were electives for the BS in Mathematics. By creating this major, we are able to align our values and priorities with the curriculum.

The proposed applied mathematics program was among the ancillary recommendations given by President Belton and confirmed by the Board of Regents. It is therefore also aligned with the future direction of PLU. Moreover, we are in conversation with the Biology Department and hope to add a biostatistics emphasis option once their new Biostatistics II course becomes a regular offering. Adding this biostatistics option would support the initiatives regarding PLU as a leader in health sciences.

- 3. Proposed Program Start Date:** Sept. 1, 2022
- 4. Program Offerings:**

- a. Describe the type of program (new degree, new major, new minor, new concentration).
- b. Identify the delivery format for the program (face-to-face, online, blended, or competency-based) and rationale for this format.
- c. Describe the curriculum and program requirements by providing a clear description of the courses required to complete the program and any program-specific policies (e.g., credit hours in residency, GPA requirements). Include course offerings, number of credits, prerequisites, and any general education elements. Clearly distinguish between existing courses and any new courses that will need to be created or deleted. If you are using preexisting catalog language, please highlight changes by using **blue boldface** for changes and ~~blue-strikeout~~ for deletions.
- d. Provide a two-year course cycle for delivering the curriculum.
- e. Provide completion pathways (including two and four-year advising plans for undergraduate programs).
- f. Identify the learning outcomes for the program. For undergraduate programs, also describe the connection to the Integrative Learning Objectives.
- g. Provide a plan for assessing program learning outcomes.
- h. Identify program entrance requirements, including application processes, if appropriate.

This program is a new major that will primarily utilize existing face-to-face courses. We propose the creation of a four-credit mathematical modeling course (MATH 422). Existing courses are currently provided regularly. There are no program entrance requirements or application processes. The number of credit hours in residency and GPA requirements are the same as for the other BS programs the Mathematics Department offers.

Proposed Major Requirements:

Major in Applied Mathematics

36-40 semester hours of mathematics, plus 8 to 13 semester hours of supporting courses

- **24 semester hours of required mathematics courses: MATH 152, 253, 318, 331, 422, 499A, 499B**
- **4 semester hours of statistics from MATH/STAT 145, STAT 231, or MATH/STAT 242.**

- 12 semester hours of electives from MATH/STAT 342, MATH/STAT 348, MATH 351*, MATH 356, MATH 433**, MATH 455**, CSCI 330, CSCI 367, CSCI 371, CHEM 341, ECON 341, ECON 344, ECON 345, PHYS 354*, PHYS 356. At least 8 semester hours of these must be taken from mathematics or statistics.
(*Only one course from either MATH 351 or PHYS 354 may be used.
**Only one course from either MATH 433 or 455 may be used.)
- 4 or 5 semester hours of supporting courses from: CHEM 115, CSCI 270, ECON 101, or PHYS 153/163 Lab
- 4 semester hours from CSCI 144 or DATA 133* (*MATH 356 or another approved 300-level or 400-level mathematics course may be substituted for this requirement if a student is completing the Data Science minor.)

A maximum of twelve (12) credits may be double-counted for other major requirements, and a maximum of eight (8) credits may be double-counted for other minor requirements. (Petitions to substitute courses may be submitted to the department chair to address double-counting constraints.) Students minoring in statistics may not use any of their "8 additional semester hours of statistics" toward the Applied Mathematics major.

The only new course is MATH 422.

Two-year course cycle:

Course number	F22	J23	S23	F23	J24	S24
MATH/STAT 145			x			x
MATH 152	x		x	x		x
MATH 242	x			x		
MATH 253	x		x	x		x
MATH 318		x			x	
MATH 331	x		x	x		x
MATH/STAT 342						x
MATH/STAT 348			x			x
MATH 351			x			x

MATH 356						x
MATH 422	x			x		
MATH 433	x			x		
MATH 455			x			x
MATH 499A	x			x		
MATH 499B			x			x
CSCI 144	x		x	x		x
CSCI 270	x		x	x		x
CSCI 330	x			x		
CSCI 367			x			x
CSCI 371	x			x		
CHEM 115	x	x		x	x	
CHEM 341	x			x		
DATA 133	x			x		
DATA 233			x			x
ECON 101	TBD	TBD	TBD	TBD	TBD	TBD
ECON 341	TBD	TBD	TBD	TBD	TBD	TBD
ECON 344	TBD	TBD	TBD	TBD	TBD	TBD
ECON 345	TBD	TBD	TBD	TBD	TBD	TBD
PHYS 153/163	x		x	x		x
PHYS 354			x			x
PHYS 356	x			x		
STAT 231	x		x	x		x

The two-year course cycle is tentative, especially in light of the recent FJC process.

Completion pathways: There are multiple completion pathways due to the fact that students come with differing calculus backgrounds, and that students choose three electives among multiple courses from different departments. Because of a wide range of electives, students completing this major who are also majoring in computer science or physics will be able to complete both without using more than 12 credits for both. The four-year pathways provided below are just two of the many possible ones and assume that students come in with MATH 151 credit, which most of our majors do. Some of the courses (MATH/STAT 342 and MATH 356) are offered only on alternate years, so these courses may have to be taken during the third or fourth year for the four-year sequence and during the first or second year for the two-year sequence, depending on when students entered PLU. The two-year pathway assumes that students have taken the calculus sequence elsewhere. The pathways also differ depending on whether students are interested in a more traditional applied mathematics path or a more statistics-oriented one.

Four-year Pathway 1 (applied mathematics, traditional emphasis):

First year: MATH 152, 253, PHYS 153/163

Second year: MATH/STAT 242, MATH 318, 331, CSCI 144

Third year: MATH 351, MATH 422, PHYS 356

Fourth year: MATH 356, MATH 499A&B

Four-year pathway 2 (applied mathematics, statistics emphasis)

First year: MATH 152, 253, ECON 101

Second year: MATH/STAT 242, MATH 318, 331, DATA 133, ECON 102

Third year: MATH/STAT 342, MATH 422, ECON 344

Fourth year: MATH/STAT 348, MATH 499A&B

Two-year Pathway 1 (applied mathematics, traditional emphasis):

First year: MATH/STAT 242, MATH 318, 331, CSCI 144, CSCI 270

Second year: MATH 351, 356, 422, MATH 499A&B, CSCI 330

Two-year pathway 2 (applied mathematics, statistics emphasis)

First year: MATH/STAT 242, MATH 318, 331, DATA 133, ECON 101

Second year: MATH/STAT 342, 348, MATH 422, MATH 499A&B, ECON 344

The BS in Applied Mathematics has the following learning outcomes:

1. Communication: Be able to read, interpret, write about, and talk about mathematics.
2. Computation: Develop computational, algorithmic, and technological problem-solving fluency.
3. Application: Be able to apply mathematical concepts to concrete situations.
4. Disciplinary Citizenship: Develop collaborative skills, independence, perseverance; have experience with open-ended inquiry.

Assessment of the program learning outcomes will be aligned with other assessment efforts already taking place in the Mathematics Department. The above-listed objectives 1, 2, and 4 are already assessed in courses that are part of the BS in Applied Mathematics. Outcome 3 will be assessed in MATH 422, which is a core course that all applied mathematics majors will take; in MATH 499B; and via exit surveys that all graduating majors complete. Assessment tools for outcome 3 will consist of: a common assignment in MATH 422, the capstone paper and presentation rubric in MATH 499B, and an additional question about application in the exit survey.

There are no entrance requirements for the program.

- 5. External Authorization:** Will the proposal require authorization from NWCCU, the state of Washington, or an external accreditation body?

No

- 6. Rationale:**

- a. Provide evidence of demand for the proposed program, which may include a market analysis or review of trends at other universities. Include reference to relevant competitors' programs and characteristics of the proposed program that will make it attractive to students in light of this competition.
- b. Identify the target audience for the program.
- c. Explain why this is the right time for the university to add this program.
- d. Explain how this program might compete with other programs currently offered at PLU.
- e. Identify which academic units might be affected by this program, and how.
- f. Will approval of this program mean the termination of another program? If so, what is the timeline for the proposed elimination?

We looked at 14 universities in Washington State for comparison. Only 6 of those have an Applied Mathematics major or concentration, none of which are in the South Puget Sound area.

As described in more detail in the EPC proposal, many of our students go on to careers in industry upon graduating from PLU; and in recent years, there has been an increase in interest in graduate programs in statistics. MATH/STAT 348 is a very popular course that filled up in less than a week during fall 2020 registration. Increasing numbers of majors choose applied mathematics topics for their capstone projects. We see all these factors as evidence that demand for an applied mathematics major exists among our current student population. In this era of dependence on data and mathematical models, we believe that the major is timely and will be attractive to prospective students.

This major is geared towards students already interested in mathematics and who are either interested in careers in industry or in enrolling in graduate programs in statistics or applied mathematics. A recent PLU graduate (mathematics major) wrote: "I think an applied math major would have better supported my interdisciplinary interests... Furthermore, I think an applied math major may have given me more skills that I could use in my career path."

Another recent graduate wrote, "I would have loved to do the applied math major because I think I would have liked more opportunities to see how my knowledge of math applied to the 'real world'. PLU did a great job teaching me the theoretical side of math and I got to explore the application of some of it through my statistics courses and my capstone, but I would have loved the opportunity to learn more about the application of different fields of mathematics. Additionally, I feel like I would have had the opportunity to explore career options through applied mathematics courses at PLU which would have helped determine my path after PLU."

A current PLU student wrote of the applied major, "If students had a specific area of math that they wanted to focus on, having an option to apply that in their degree would be really beneficial. If there had been an option for an Applied Mathematics major when I started at PLU where I could have taken more specialized courses in Statistics and Data Science for example, that would have been something that I would have been interested in when I was an incoming student. I have always wanted to do more of an applied math route in my career and if applied math had been an option at PLU I definitely would have chosen it. I also think it would be a very significant draw for other incoming students. Since the majority of students

who are coming to PLU are drawn by the well rounded liberal arts aspect of their education, having a math major that allowed you to take courses based on your specific interests would be a great way to apply that liberal arts aspect that PLU prides itself in. Because of that, having a degree that allowed you to take math courses that specialized in a specific area would be a really great opportunity for students like me and PLU as a whole.”

Due to its interdisciplinary nature, the applied mathematics major would pair well with other Natural Sciences majors such as Computer Science or Chemistry, as well as with an Economics or Data Science minor, for example. We have carefully considered the double-dipping issue and found that allowing twelve credits to count toward this and another major will not result in too much overlap while allowing students to complete both majors during their time at PLU. As mentioned above, we plan to incorporate a biostatistics emphasis option when the biology department makes their Biostatistics II course a regular offering.

Because the major builds on already existing courses, it should not compete with other programs in our department. We do not foresee that it will result in the termination of another program. During the 2021 exit interviews with graduating majors we found that while some students would have preferred to major in applied mathematics, others expressed preference for theoretical mathematics. We anticipate that both majors will be attractive to students.

The applied mathematics program could result in increased enrollment in courses from other departments that can be taken as applied mathematics electives, and could also result in more mathematics majors minoring in other, related fields.

7. Marketing strategies:

- a. Provide a marketing and advertising plan for the initial roll-out of the program, including a timeline.
- b. Identify longer-term plans for marketing and advertising.

This program is meant to appeal to prospective and current PLU students. Advertising and marketing at PLU will include information sessions during the academic year and advertising within the department and through the Division of Natural Sciences. Advertising to prospective students will include providing information materials to local high schools, in particular, to the Science and Math Institute (SAMI), which is a part of the Tacoma Public Schools system.

This major will also be highlighted to Student Success advisors.

8. External funding sources: Describe any plans for the development of funding sources for this program that are external to the university, including projected amounts of funding for each.

- a. Fundraising: N/A
- b. Grants:
- c. Other:

There are no external funding sources for this program.

9. Faculty, Staff and Administration:

- a. Describe the qualifications needed by faculty who will teach in the program.
- b. Identify the number and type (contingent, tenure-track) of faculty members necessary to deliver the program.
- c. Will any current faculty serve in the proposed program? If so, how will this new commitment be accommodated in their teaching load?
- d. Identify the number and type (contingent, tenure-track) of *new* faculty necessary to deliver the program.
- e. If new faculty are required, provide a recruitment plan and timeline, including comments addressing the challenges of filling positions with small hiring pools or where market premia might be required
- f. Describe plans for providing administrative support for the program. Identify any new administrative positions or organizational rearrangements in staff needed to accommodate the new program.

The proposed major utilizes existing courses, except for requiring the creation of a permanent mathematical modeling course. Historically, the department has offered an abbreviated modeling course as a 1-credit J-term course each year, taught by uncompensated faculty members. In Spring 2021, the course was piloted as a 4-credit course. As a 4-credit course with faculty compensation, it is more sustainable and more attractive to faculty. As a four-credit course, it should be more attractive to students since it can cover far more topics that are appropriate for the major, and cover those topics with greater depth. Furthermore, a mathematical modeling course is essential to any applied mathematics major. Multiple faculty in the department are qualified to teach the course, and we have been able to adjust offerings of other courses in the department to make room for the course without adding any FTE. For these reasons, no new faculty are needed to deliver this program. No new administrative positions or organization rearrangements are anticipated for this major.

10. Facility and Technology Needs – Includes but not limited to classroom, office, studio, laboratory, storage, technology, and computer labs.

- a. Describe any new construction or facility renovations necessary to launch or maintain the program and the associated expenses.
- b. Describe any furniture and/or equipment necessary to launch or maintain the program.
- c. Explain any special security considerations associated with the program.
- d. Identify possible health and safety concerns associated with the program.

No new facility or technology needs are anticipated for this program.

11. Library Resources:

- a. Describe library resources needed to support the program, including print books, electronic materials, and other library resources.
- b. Does the new program require access to library resources not already available? Are these mandated by any program accreditation?
- c. If program is fully online or blended, describe how library resources will be delivered to students. Include expenses for postage, photocopying, etc.

No new library resources will be needed to support the program.

12. Student Services—Are there any changes in existing student services needed to accommodate the program? Will adding the program result in changes in service provision to the rest of the student body? Where might additional resources be necessary, and what are the projected expenses for those resources?

- a. Financial aid
- b. Registration
- c. Center for Student Success (advising, tutoring)
- d. Other

No new student services are anticipated for this program.

13. **Budget.** Use information from the questions above to complete the table. Please see footnotes for additional information.

Year	Year Zero	Academic Year 1	Academic Year 2	Academic Year 3	Academic Year 4
# Students in Program ⁱ	0	2	4	6	6
# Faculty FTE to Deliver Program ⁱⁱ	0	6-7	6-7	6-7	6-7
# New Faculty FTE to Deliver Program ⁱⁱⁱ	0	0	0	0	0
Average Faculty Salary in unit ^{iv}	-	-	-	-	-
# Administrators or Staff ^v	0	0	0	0	0
# New Administrators or Staff ^{vi}	0	0	0	0	0
Average Administrator or Staff Salary ^{vii}	-	-	-	-	-
Services & Purchases ^{viii}	0	0	0	0	0
Facility and Technology ^{ix}	0	0	0	0	0
Library Resources ^x	0	0	0	0	0
Student Services ^{xi}	0	0	0	0	0
Net	0	0	0	0	0

- i. Identify the projected number of students *declared* in the new program for each of the first four years of the program.
- ii. Identify projected faculty FTE for each of the first four years of the program.
- iii. Identify the number of additional (new) faculty FTE (whether new of contingent) necessary to add in each of the first four years of the program.
- iv. Identify average faculty salary in the proposed program in consultation with the Provost's Office.
- v. Indicate the projected staff/administrator FTE for each of the first four years of the program.
- vi. Identify the number of additional (new) staff/administrator FTE necessary to add in each of the first four years of the program.
- vii. Indicate the average staff/administrator salary.

viii. Indicate the annual services and purchases budget required for each of the first four years of the program, including any projected expenditures required for start-up expenses. *Itemize these expenses in an attached narrative.*

ix. Estimate facilities and technology expenses for each of the first four years of the program.

x. Estimate library expenses for each of the first four years of the program.

xi. Estimate student services expenses

14. Risk management

Describe the major risk considerations of the plan and the steps that could be taken to mitigate or minimize the risk and still implement a successful plan. For example, if applicable, the plan may encounter problems associated with items such as negotiating a lease contract, obtaining city or government approvals, obtaining accreditation approval, etc.

This program has no risk. There is no approval needed and no leases to be signed.

15. Accountability and Exit Strategy:

a. Outline the steps that will be taken to review whether the program is meeting its enrollment and revenue targets, including the timeline for such review. For new undergraduate programs, provide a 5-year timeline; for new graduate programs, provide a 3-year timeline.

b. Provide an exit strategy, including a general timeline for deciding whether to terminate or continue the program and a plan for teaching out the program.

c. Identify who will be responsible for providing accountability and oversight for the program meeting its enrollment and revenue targets.

Because the program does not require any new FTEs there are no new costs associated with it. The major should be assessed within 3 years to determine whether it is meeting enrollment targets of 6 students per year. The program does not have revenue targets.

16. **Communications Checklist.** The persons/offices listed below should be consulted as the proposal is prepared.

	Signature	Date	Level of Support: <ul style="list-style-type: none"> • Support • Undecided • Do not support
Chair	KSENYA SIMIC HULLER	6/2/21	email support
Dean	APU AHMED	6/2/21	SUPPORT
Associate Provost for Undergraduate or Graduate Studies, as appropriate	Jan LEWIS	6/7/21	SUPPORT
Provost			
Accreditation Liaison Officer	Karen McConnell	6/11/21	email support
Director of the Library	Fran Lane Rogus	6/15/21	email support
Registrar	Kelly Roth	6/16/21	email "Support"
Student Financial Services	Mike Frechette	6/29/21	email support
Director of Admission	Melody Ferguson	6/28/21	email support
Executive Director Center for Student Success	Kris Plachn	6/11/21	Support
Vice President for Administrative Services	TERI Phillips	6/4/21	email support

May 2020

Educational Policies Committee
Curriculum Change Template

Current Courses	Current Hours	Proposed Courses	Proposed Hours
BS: Mathematics	48-49 hrs	BS: Mathematics	48-49 hrs
MATH 152	4 hrs	MATH 152	4 hrs
MATH 242	4 hrs	MATH 242	4 hrs
MATH 253	4 hrs	MATH 253	4 hrs
MATH 317 or 318 or 319	4 hrs	MATH 317 or 318 or 319	4 hrs
MATH 331	4 hrs	MATH 331	4 hrs
MATH 433	4 hrs	MATH 433	4 hrs
MATH 455	4 hrs	MATH 455	4 hrs
MATH 499A	2 hrs	MATH 499A	2 hrs
MATH 499B	2 hrs	MATH 499B	2 hrs
Pick two additional from MATH 317/318/319, 342, 348, 351*, 356, 381, 480, or PHYS 354 <i>(* At most, one of MATH 317, 318, and 319, not already used in the bullet points above, can be used toward the 8 additional semester hours of electives needed. **Only one course from either MATH 351 or PHYS 354 may be used.)</i>	8 hrs	Pick two additional from MATH 317/318/319, 342, 348, 351*, 356, 381, 422 , 480, or PHYS 354* <i>(* At most, one of MATH 317, 318, and 319, not already used in the bullet points above, can be used toward the 8 additional semester hours of electives needed. **Only one course from either MATH 351 or PHYS 354 may be used.)</i>	8 hrs
CSCI 144	4 hrs	CSCI 144	4 hrs
Pick one from CSCI 371, ECON 345, or PHYS 153/163 Lab	4-5 hrs	Pick one from CSCI 371, ECON 345, or PHYS 153/163 Lab	4-5 hrs

t

Course	Course Title	# Fall Sections	# J-Term Sections	# Spring Sections	Total # Sections	Multi-Disciplinary Program courses taught by the department [please specify which program(s)]	Comments
MATH 105	Mathematics of Personal Finance (MR,	1	0	1	2		
MATH 107	Mathematical Explorations (MR, NS)	0	1	0	1		
MATH 115	College Algebra and Trigonometry (MR,	1	0	1	2		
MATH 123	Modern Elementary Math I: Number Sense and Algebraic Sense (MR, NS)	1	0	1	2		
MATH 124	Modern Elementary Math II: Measurement, Geometric Sense, Statistics and Probability (MR, NS)	1	0	0	1		
MATH 128	Linear Models and Calculus, An Introduction (MR, NS)	2	0	1	3		
MATH 140	Precalculus (MR, NS)	2	0	1	3		
MATH/STAT 145	Statistics for Biologists (MR, NS)	0	0	1	1		
MATH 151	Introduction to Calculus (MR, NS)	2	0	2	4		
MATH 152	Calculus II (MR, NS)	1	0	1	2		
MATH/STAT 242	Introduction to Mathematical Statistics (NS)	2	0	0	2		
MATH 245	Discrete Structures (NS)	0	0	1	1		
MATH 253	Multivariable Calculus (NS)	1	0	1	2		
MATH 317	Introduction to Proofs: Number Theory (NS)	1	0	0	1		
MATH 318	Introduction to Proofs: Combinatorics	0	1	0	1		
MATH 319	Introduction to Proofs: Geometry (NS)	0	0	1	1		
MATH 331	Linear Algebra (NS)	2	0	1	3		
MATH/STAT 342	Probability and Statistical Theory	0	0	0	0		
MATH/STAT 348	Statistical Computing and Consulting	0	0	1	1	Data science	
MATH 351	Differential Equations (NS)	0	0	1	1		
MATH 356	Numerical Analysis (NS)	0	0	0	0		
MATH 422	Mathematical Modeling	1	0	0	1		
MATH 433	Abstract Algebra	1	0	0	1		
446	School	1	0	0	1		
MATH 455	Mathematical Analysis	0	0	1	1		
MATH 480	Topics in Mathematics	0	0	0	0		
MATH 499A	Capstone: Senior Seminar I (SR)	1	0	0	1		
MATH 499B	Capstone: Senior Seminar II (SR)	0	0	1	1		

2021-2022 Academic Year

Course	Course Title	# Fall Sections	# J-Term Sections	# Spring Sections	Total # Sections	Multi-Disciplinary Program courses taught by the department [please specify which program(s)]	Comments
MATH 105	Mathematics of Personal Finance (MR, NS)	1	0	1	2		
MATH 107	Mathematical Explorations (MR, NS)	0	1	0	1		
MATH 115	College Algebra and Trigonometry (MR, NS)	1	0	1	2		
MATH 123	Modern Elementary Math I: Number Sense and Algebraic Sense (MR, NS)	1	0	1	2		
MATH 124	Modern Elementary Math II: Measurement, Geometric Sense, Statistics and Probability (MR, NS)	1	0	0	1		
MATH 128	Linear Models and Calculus, An Introduction (MR, NS)	2	0	1	3		
MATH 140	Precalculus (MR, NS)	2	0	1	3		
MATH/STAT 145	Statistics for Biologists (MR, NS)	0	0	1	1		
MATH 151	Introduction to Calculus (MR, NS)	2	0	2	4		
MATH 152	Calculus II (MR, NS)	1	0	1	2		
MATH/STAT 242	Introduction to Mathematical Statistics (NS)	2	0	0	2		
MATH 245	Discrete Structures (NS)	0	0	1	1		
MATH 253	Multivariable Calculus (NS)	1	0	1	2		
MATH 317	Introduction to Proofs: Number Theory (NS)	1	0	0	1		
MATH 318	Introduction to Proofs: Combinatorics (NS)	0	1	0	1		
MATH 319	Introduction to Proofs: Geometry (NS)	0	0	1	1		
MATH 331	Linear Algebra (NS)	2	0	1	3		
MATH/STAT 342	Probability and Statistical Theory	0	0	1	1		
348	Consulting	0	0	1	1	Data science	
MATH 351	Differential Equations (NS)	1	0	0	1		
MATH 356	Numerical Analysis (NS)	0	0	1	1		
MATH 422	Mathematical Modeling	1	0	0	1		
MATH 433	Abstract Algebra	1	0	0	1		
C 446	School	0	0	0	0		
MATH 455	Mathematical Analysis	0	0	1	1		
MATH 480	Topics in Mathematics	0	0	0	0		
MATH 499A	Capstone: Senior Seminar I (SR)	1	0	0	1		
MATH 499B	Capstone: Senior Seminar II (SR)	0	0	1	1		