Foundations Course Designation Proposal:
Quantitative Reasoning

UH Mānoa departments are invited to complete this proposal form for any 100- or 200-level course that meets the Foundations Quantitative Reasoning (FQ) Hallmarks. Departments are encouraged to contact the General Education Office early in their proposal development so that consultation can be arranged with the Foundations Board.

Departments are encouraged to submit proposals prior to the listed deadline to aid in the negotiation process that is sometimes necessary to secure approval for the desired start term.

Proposal forms – including all applicable supporting documentation – may be submitted to the General Education Office in either of the following ways:
1. Hard copies delivered in-person or via campus mail to Bilger 104
2. Electronic copies emailed to gened@hawaii.edu

Deadlines: **Monday, September 30, 2019 for <u>Summer or Fall 2020</u> effective term**
Tuesday, February 18, 2020 for <u>Spring 2021</u> effective term

REQUIRED INFORMATION

A. *Course information.* Subject _____ Course number _____
(e.g., "ANTH")

If the course is cross listed, provide the cross-listing: Subject _____ Course # _____

Course title: _____

B. *Course description.* Submit a copy of the official course description. The course description must reflect the FQ Hallmarks.

C. *UHM Form.* If this is a new course, please ensure you submit a completed UHM-1 form to the OVCAA by the published deadline. If any modifications are being made to the course, please submit a completed UHM-2 form. For more information, visit: https://manoa.hawaii.edu/ovcaa/planning_approval/course_approval.html

D. *Course syllabus.* Submit the master syllabus, including a calendar of topics, readings, and major assignments, that will be used as the course framework. If multiple instructors teach the course and use varying texts and/or assignments or will offer the course in an online format, include all representative syllabi.

E. *Application of Hallmarks.* Provide a considered response to each of the following questions.
Please see pages 3-4 for the full listing of Learning Objectives, Hallmarks and Explanatory Notes.

1a. What mathematical or statistical methods, formulas, tools, and/or approaches will be explored in the course?

1b. How will the instructor introduce the theoretical justifications for and limitations of these methods, formulas, tools, or approaches?

2a. Where in the course will the instructor integrate real-world problems and practical applications?

2b. Provide sample activities, assignments/projects, and/or test questions that demonstrate the integration of real-world problems and practical applications into the course.

3a. Describe the kinds of activities, assignments, and/or online resources that will be used in the course to facilitate interaction in a 30:1 learning environment.

3b. What kind of feedback will students receive from the instructor, peer tutors, teaching assistants, and/or graduate assistants on a weekly basis?

3c. If peer tutors, teaching assistants or graduate assistants will be utilized, what kinds of support or training will the department provide them so they can effectively support student learning of quantitative reasoning skills?

4. Where in the course will students demonstrate the five quantitative reasoning skills listed in Hallmark 4? To address this question:
   o Provide sample assignments and model solutions/products that reflect the five skills outlined in Hallmark 4.

   o Provide context for the sample assignments and model solutions/products so it is clear how these assignments are incorporated into the course and intended to promote student learning of the skills outlined in Hallmark 4.

F. *Assessment*. Include a summary of your assessment plan that clearly addresses the following questions:
   i. How will instructors assess student competencies in meeting the FQ learning objectives (e.g., rubrics, learning artifacts, etc.)?

   ii. How will the department utilize assessment data to improve the course?

   Note: Assessment plans do not refer to how students will be graded in the course.
   Departments will be asked to summarize their assessment findings as part of the renewal application.

G. *Course coordinator.* Identify the faculty or staff member who will be responsible for all of the following:
   • serving as the official contact person regarding this course;
   • having detailed knowledge of course content and curriculum;
   • collecting and reviewing syllabi to make sure all sections – including those conducted in an online format – are taught with adherence to the Hallmarks;
   • providing professional development support as needed to instructors teaching the course.

_____   _____   _____

Course coordinator's printed name   Course coordinator's email   Campus phone

H. *Departmental Approval*.

_____   _____   _____

Department chair's printed name   Department chair's signature   Date

_____   _____   _____

Dept. chair's email   Campus address   Campus phone

Thank you for your submission. The Foundations Board reviews all Foundations proposals to ensure that courses meet the appropriate Hallmarks and Learning Objectives. If clarification is needed, a board member will contact the course coordinator. If the Foundations Board approves the proposal, all sections of the course will be designated as satisfying the requirement and are expected to remain in compliance of the FQ Hallmarks and Learning Objectives.

Please contact the General Education Office at 956-6660 or gened@hawaii.edu with any questions.

FQ STUDENT LEARNING OBJECTIVES
Explanatory notes appear in italics.

Students will be able to:

FQLO1. **Select** an appropriate mathematical approach for a given problem or practical application, identify relevant quantities or other information for the selected approach, and verify that the assumptions and limitations of the mathematical approach selected are appropriate for the relevant practical problem;
- *Herein, a "mathematical approach" refers to a set of formulas, models, algorithms, or other mathematical or statistical methods.*

FQLO2. **Convert** relevant quantities/information into the necessary symbolic, numerical, or graphical form as needed for the selected approach;
- *Conversion includes explaining the meanings of individual variables in a given context, and correctly associating quantities with their corresponding variables.*

FQLO3. **Use** mathematical approaches successfully, including performing correct chains of algebraic steps, symbolic manipulations, and/or numerical calculations;
- *Successful use also includes identifying the names and explaining the meanings of operational symbols and using them correctly in a given context.*

FQLO4. **Evaluate** the validity of a mathematical approach and its conclusions;
- *Evaluation may include: verifying correctness of solutions, where possible; reevaluating initial assumptions; assessing reasonableness of numerical results in practical applications or physical contexts; applying other accepted methods of judgment within particular disciplines.*

FQLO5. **Communicate** final conclusions in appropriate formats.
- *Appropriate formats may include symbolic expressions, graphs, or written statements.*
- *Final conclusion statements should reflect the outcome of deductive or statistical reasoning.*

FQ HALLMARKS
Hallmarks appear in bold; explanatory notes appear in italics.

Introduction: FQ courses should strive to impart an appreciation for the relevance and usefulness of quantitative reasoning. We define quantitative reasoning as the ability to apply mathematical concepts to the interpretation and analysis of quantifiable information, expressed numerically or graphically, in order to solve a wide range of problems, from those arising in pure and applied research to everyday issues and questions. It includes the ability to:
- understand and communicate quantitative information using such tools as variables and equations, graphs and charts, words/sentences;
- apply math skills;
- judge reasonableness of results; and
- recognize the limits of mathematical or statistical methods.

The primary goal of FQ courses is to teach mathematical reasoning and tools at the college level. While additional course material (natural science, social science, etc.) can serve as a valuable context for learning these skills, it should not overshadow the primary goal.

To satisfy the FQ requirement, a course will:
1. **provide students with theoretical justifications for, and limitations of, mathematical or statistical methods, and the formulas, tools, or approaches used in the course;**

2. **include application of abstract or theoretical ideas and information to the solution of practical quantitative reasoning problems arising in pure and applied research in specific disciplines, professional settings, and/or daily and civic life;**
   - *A minimum of 10% of course content (lecture content, homework problems, and exam problems) should include practical examples. Faculty members are encouraged to exceed this.*
   - *Practical examples might involve a physical situation, professional application, or daily life. Faculty members are encouraged to situate some practical examples in a rich context.*
   - *Practical examples should be integrated throughout the academic term.*

3. **provide opportunities for practice and feedback that are designed to help students evaluate and improve quantitative reasoning skills by including a course component at least once per week with a maximum 30:1 student-to-teacher ratio;**
     - *Examples of acceptable formats include, but are not limited to: small lectures with maximum enrollment of 30 students; large lectures with 30-student-maximum weekly recitation sections, discussion sections, or problem sessions led by trained graduate assistants or trained undergraduate peer-tutors; large lectures with weekly 30-student-maximum supervised computer lab sessions designed to reinforce and practice lecture material.*
     - *Acceptable training for graduate students and undergraduate peer-tutors may include, but is not limited to, University and/or Departmental start-of-semester TA training, weekly course TA meetings, or other consistent guidance and supervision by faculty.*

4. **be designed so that students will be able to:**
     a. **identify and convert relevant quantitative information into various forms such as equations, graphs, diagrams, tables, and/or words;**
     b. **select appropriate techniques or formulas, and articulate and evaluate assumptions of the selected approaches;**
     c. **apply mathematical tools and perform calculations (including correct manipulation of formulas);**
     d. **make judgments, create logical arguments, and/or draw appropriate conclusions based on the quantitative analysis of data, the assumptions made, the limitations of the analysis, and/or the reasonableness of results;**
     e. **effectively communicate those results in a variety of appropriate formats.**
       - *Individual practical examples will likely emphasize some aspects of this hallmark while omitting others. However, the course as a whole must ultimately address each aspect of this Hallmark.*
       - *Hallmark 4 is intended to help students identify the major components or factors involved in an analytical problem and determine the arrangement of evidence in evaluating the problem.*