

# Leeward Community College

## Accelerated Pre-Calculus

**1. Course Alpha**

MATH

**2. Course Number**

140X

**3. Number of Credits**

4.0

**4. Effective Term**

Fall 2010

**5. Course Title**

Accelerated Pre-Calculus

**6. Catalog Title**

Accelerated Pre-Calculus: Elementary Functions, Trigonometry, &amp; Analytic Geometry

**7. Prerequisites**

Any one of the following, or an articulated equivalent, within the past two years, will qualify a student for MATH 140X: A in MATH 103 OR C in MATH 135 OR qualified placement test score (62 or higher in the COMPASS college algebra placement domain) OR "well prepared" designation in the Algebra II End-Of-Course exam OR instructor consent.

**8. Corequisites**

None

**9. Recommended preparation**

None

**10. Catalog Description**

MATH 140X is designed to provide an accelerated path to Calculus to students who have a strong background in College Algebra. Topics include the essential pre-calculus skills needed for success in calculus: functions, with special attention to polynomial, rational, exponential, logarithmic, and trigonometric functions; plane trigonometry; polar coordinates; and conic sections. Credit may not be earned for both MATH 140 and MATH 140X.

**11. What are the general student learning outcomes? (What knowledge and/or skills will successful completion develop in the students?)**

Upon successful completion of Math 140X, a student should:

- Evaluate and simplify algebraic and trigonometric expressions by applying appropriate formal rules or algorithms.
- Analyze and graph functions and equations involving algebra, trigonometry, and analytic geometry.
- Construct proofs using trigonometric identities.
- Apply theory from algebra, trigonometry and analytic geometry to model and solve various real world application problems.
- Select and correctly utilize precise mathematical language and symbols to effectively communicate procedures and results.

**12. Course Content**

**What evidence exists that the course content is appropriate, relevant, and covered in sufficient depth? (addresses breadth, depth, relevancy) What evidence exists that the course reflects current theory and practice in the content area? (addresses currency)**

Basic Concepts of Functions and Related Operations

- Review of essential graph properties including transformations
- Algebra of Functions
- Compositions of Functions
- Inverse Functions

Polynomial Functions

- Review of linear functions and quadratic functions
- Properties and Graphs of Polynomial Functions

Rational Functions

- Review of power functions
- Properties and graphs of rational functions

Exponential and Logarithmic Functions

- Exponential functions
- Properties of logarithms
- Logarithmic functions
- Exponential and logarithmic expressions and equations
- Applications involving exponential and logarithms

Trigonometric ratios and functions

- Trigonometric ratios of acute angles
- Radian measure and trigonometric functions of variables expressed in general angles or radian measure
- Properties and graphs of trigonometric functions
- Applications

## Analytic trigonometry

- Trigonometric identities
- Inverse trigonometric functions
- Expressions and equations involving trigonometric functions and inverse trigonometric functions
- Applications

## Further topics in trigonometry

- Law of Sines and the Law of Cosines
- Polar coordinates
- Applications

## Conic Sections

- Essential Properties
- Graphs
- Equations

Evidence that these topics are appropriate, relevant, and covered in sufficient depth include:

- These topics correspond to the topics currently collectively covered in Leeward CC's MATH 135 and 140 courses. Rather than including enrichment topics and spiraling the level of difficulty over the two courses, MATH 140X covers only the material that is needed for success in Calculus in a single semester, as is done at UH Manoa. Since the prerequisite is an "A" in Math103, the students enrolled in MATH140X should be able to handle the rigor and accelerated pace. In addition, the two additional contact hours of lab work with help ensure the students' success.
- Since MATH 140X essentially duplicates the topics covered in UH Manoa's existing MATH 140 course, it is anticipated that existing articulation agreements that apply to UH Manoa's MATH 140 will be extended to MATH 140X.
- These topics and their depth of coverage correspond to the standard topics in pre-calculus textbooks that are widely used nationally and thus vetted by peer institutions.

Evidence that the course reflects current theory and practice in the content area include:

- A wide selection of current textbooks and technology will be reviewed and considered before the course content and anticipated course procedures are decided on by a committee of Leeward CC math faculty, who have been teaching a variety of courses over many years.
- The anticipated course procedures follow contemporary principles of course redesign as promulgated by national organizations.
- Student learning will be supported by current mathematical educational software that has been vetted by many peer colleges nation-wide and whose contemporary successes have been widely documented.

**13. How is this course related to the educational needs and goals of the division, college, and community as reflected in the Strategic Plan? How is it related to courses and programs in other disciplines?**

This course addresses strategic outcome II.2.B of the 2008-2015 Strategic Plan Update: Modify the traditional structure and delivery of programs to accommodate the full-time adult student and that shortens student time to degree.

This course also addresses strategic outcome III.3.B of the 2008-2015 Strategic Plan Update: Articulate associate degrees and/or certificates with baccalaureate programs in STEM fields at UH

and other 4-year campuses to shorten time to degree.

MATH 140X covers the essential topics in the current pair of courses MATH 135 and 140 into a single course. By potentially reducing the time needed to reach Calculus from two semesters to one so students intending a STEM (Science, Technology, Engineering, and Mathematics) major can reach Calculus I a semester sooner than they could with the existing pre-calculus sequence.

- 14. For what program was the course designed? Is it an approved program? Will the course be required or elective? Will the course lengthen the time for the students to complete the program? Will it replace another course?**

This course is expected to fulfill the Foundation Symbolic Reasoning (FS) 3-credit core requirement for the Leeward CC A.A. degree and UH Manoa. The Leeward CC A.A. degree as well as UH Manoa B.A./B.S. programs are approved programs. This course will shorten the time for the student to complete a program and is intended to coexist alongside MATH135 and MATH140.

- 15. How many hours will the students spend per week in lectures, laboratories, seminars, or other supervised instruction?**

For this four credit course, the student will spend a total of five hours a week in class. Three of those hours will be spent in lecture and two of those hours will be in a lab setting where students will be involved in activities that may include working on appropriate computer-based supplements, recitations, quizzes, exams, and reviews.

- 16. What independent work will be required of students? (Reading, research, writing, special projects, etc.) For written or other special projects, identify the usual number and length of projects. For readings, where the entire book or pamphlet is not used, indicate the portion of the material to be used.**

Depending on the instructor, students will be expected to perform some combination of the following independent work for Math 140X:

- Attend the lectures and take notes
- Read related material in the textbook
- Prepare and possibly submit homework assignments
- Write and submit in-class and/or take-home quizzes
- Write and submit "mid-term" exams, which can be formatted as in-class, or take-home, or part in-class and part take-home
- Extensive use of a computer-based supplement such as MyMathLab or MathZone.

- 17. What experiential or professional preparation is required to teach this course? Do we have a full-time faculty member who meets these requirements? If not, who will teach the course?**

An instructor for this course would need to meet the minimum qualifications for a full-time Instructor in Mathematics. By system-wide Deans' agreement, this requirement is currently a Master's degree in Mathematics. We do have full-time faculty members who meet the requirement.

- 18. Is a similar course taught at any other community college? Any other UH college? If so, provide information about the course identification and content of similar courses. If this course differs in important ways from existing similar courses, explain how.**

MATH 140X will be comparable in content and scope to UH Manoa Math 140 (Pre-Calculus, 3cr). Upon successful completion of MATH 140X, students will have mathematical backgrounds comparable to those completing MATH 140 at any UH campus.

- 19. If this course is comparable to a course taught on a four-year campus, and is intended to count in lieu of that course, the proposal must contain evidence of up-to-date information as to the content and objectives of the course on the four-year campus. (This information may be obtained through discussion with faculty teaching the course on the four-year campus or by obtaining a copy of the course syllabus or outline.)**

The content of MATH 140X was chosen to mirror the content of UH Manoa's MATH 140 (Pre-Calculus). This was done through an extensive review of UH Manoa's MATH 140 materials.

- 20. If the course is appropriate for articulation with the UH Manoa general education core or with any other department or college requirements on a UH four-year campus, provide a brief rationale.**

After the course proposal is approved, an application to the Leeward CC Foundations Board will be submitted for Symbolic Reasoning (FS) designation. Once the course and foundations application are approved, the course will by E5.209 (updated August 25, 2006) be articulated as meeting the symbolic reasoning core requirement at any UH campus adopting the Common Foundations Program described in Memorandum appendix to E5.209 (promulgated May 20, 2004).

## **21. Methods of instruction**

- Class Discussion
- Computer Activities
- Internet enhancement
- Other
- Problem-based learning

Many different modes of instruction, which are all nationally recognized in the mathematics discipline, are used to help students learn and understand mathematical reasoning in MATH 140X. The campus and system mathematics faculty regularly engage in dialogue with each other regarding interesting, innovative, successful, and unsuccessful techniques to assist students in learning mathematics. These dialogues include the semi-annual Pacific Island Mathematical Association of Two-Year Colleges conferences and the semi-annual Hawaii Council of Teachers of Mathematics conferences that a number of Leeward CC faculty regularly attend.

## **22. Methods of Evaluation**

- Exam
- Others
- Student participation

Method of Evaluation
Exam
Others

Student participation

Others: Computer-based homework supplements

### 23. Is Textbook Required

Yes, a textbook is required.

### 24. Exclude from Catalog

NO

### 25. Justify the level of proposed course:

**What evidence exists that the course appropriately covers areas with sufficient emphasis for a remedial, a developmental, or a college-level course? (addresses rigor)**

The course alpha and number for this course is Math 140 at UH Manoa and all of the CC's of the UH System. This course articulates with the other Hawaii community colleges and UH Manoa for course content and level. It is transferable to HPU and Chaminade. The course outline, syllabi and course assignments indicate that high expectations are held for students. Feedback for students is prompt and frequent Assignment and homework exercises are an integral part of the course. The level of difficulty of assignments is consistent with those required of similar courses at other institutions. Course content is consistent with current textbooks in the subject area. The students are expected to put in two extra hours outside of class for each hour spent in class. Any articulation agreements with our other sister campuses are incorporated into the course to ensure that the standards set up for the course are at a high level.

### 26. Will this course require additional staff, equipment, facilities, or other cost items? If so, are they available? Are they included in the budget, or will they be covered by reallocation?

This course will either replace existing sections of MATH 135 and/or MATH 140 or will be added to the schedule as a reflection of increased enrollment and demand. In the first case, the course will not require any additional staff, equipment or costs. In the second, additional staff will be required but the increase in tuition revenue from the additional students should cover the cost of the additional instructors/lecturers.

### 27. Expectations for Student Participation. Students are expected to spend at least two hours outside of class for every hour in class by means of the following activities:

- Computer Projects
- Homework Assignments

Working with Computer-based supplements

### 28. What change is proposed in the course? (Provide specific information on both the new and the old course.)

N/A

**29. What is the rationale for the change?**

N/A

**30. Is the change substantive enough to require a change in course identification? If so, explain in detail.**

N/A

**31. Is the course currently articulated with any four-year program? If so, give details and dates of agreement(s) and explain any impact the proposed change may have upon articulation.**

The content of MATH 140X was chosen to mirror the content of UH Manoa's MATH 140 (Pre-Calculus). This was done through an extensive review of UH Manoa's MATH 140 materials. Articulation is anticipated.

**32. Will the change require additional staff, equipment, facilities or other resources? If so, provide details and indicate whether they are available.**

No

**33. Will this change increase or decrease the number of required hours for attainment of a certificate or a degree? If so, provide details and justification.**

Decrease. A student who initially places into MATH103 and receives an "A" in the class can take MATH140X and enroll in Calculus a semester earlier than those taking the non-accelerated courses.

**34. Distance Education**

- a) what methods will be employed to ensure timely and effective interaction between faculty and students and student to student?
- b) What technological skills will students need to succeed in this course?
- c) How will the instructor execute and ensure the rigor and breadth of the course through electronic delivery?

This course is not currently offered as a distance education course.

**35. Distance Education**

What type of academic support and technology training will be required to ensure pedagogical development of the instructor for this course?

This course is not currently offered as a distance education course.

**36. Distance Education**

How will specific technology be integrated into the course, and how will its use be appropriate to the nature and objectives of the course?

This course is not currently offered as a distance education course.

**37. Course Curricular Function: (Please explain the function of this course as it relates to the College Mission and the achievement of relevant degree and certificate program requirements.)**

mission and the achievement of relevant degree and certificate program requirements.)

Math 140X is expected to meet the Leeward CC A.A degree's Foundation Symbolic reasoning (FS) 3-credit requirement and functions as part of the mathematics course sequence.

One of the principles in Leeward CC's Mission Statement (Leeward CC 2009-2010 Catalog) states "Learning and Teaching: To specialize in the effective teaching of remedial/developmental education, general education, and other introductory liberal arts, pre-professional, and selected baccalaureate courses and programs, with the goal of seamless system articulation and transfer, where appropriate. To structure our programs in such a way that they reflect not only academic rigor but also student development, learning outcomes and student goals.

**38. What evidence exists that the course is taught so that skills are built on what has been learned earlier in the course (or in a previous course) and will lead to what will be learned in a future course?**

Students who wish to further their study in any of the science disciplines and some of the other disciplines will need to take at least one Calculus course, which has Math 140 or Math140x as a prerequisite. The Mathematics Department has carefully planned the sequencing of all mathematics courses that lead to the associate degree or any of the certificates. The courses have been reviewed for prerequisites and updated for currency of content and skills required to maximize student learning. The course sequence has been articulated with other Hawaii community colleges and UH Manoa. The courses are designed to enable students to have the required mathematical skills to be successful in the subsequent course or to enable the student who transfers to another campus to be successful in the next course in the sequence.

On October 4, 2003, there was a system-wide math course coordination meeting at Kapiolani CC which included representatives from all of the Math Departments in the UH System, including the seven community colleges, UH Manoa, UH West Oahu and UH Hilo. During the meeting, the Pre-Calculus course content and expectations were discussed and agreed upon.

**39. Comments**

The discipline vote was 21 for, 0 against, and 0 abstained.

**40. Justify the need/demand for the proposed course. (Attach documentation, e.g., surveys, reports, advisory committee recommendations, etc.)**

Due to the initiatives in the 2008-2015 Strategic Plan Update that call for increasing the number of STEM degrees/certificates, more sections of Pre-Calculus will be needed. This proposed course will provide the better-prepared students with a shorter pathway to Calculus than the existing two-semester Pre-Calculus sequence.

**41. If the course is renumbered to be 100 or above, how does it meet the criteria for Transfer Courses, Attachment III? An analysis as to how those criteria are met should be provided.**

Not applicable since this course is a new proposal rather than a renumbering.



