

MATHEMATICS

To: Mathematics and counseling faculty at two-year colleges.

From: The Intersegmental Major Preparation Articulated Curriculum (IMPAC) Mathematics Advisory Committee

As a result of the consultations with Mathematics Departments of the University of California System, The California State University System, and the California State Community College System, the following recommendations are provided to assist students at community colleges in planning programs with a major in mathematics. These recommendations will be valuable for students in making the transition to a university as efficient and effective as possible for the completion of a bachelor degree with a major in mathematics.

GENERAL RECOMMENDATIONS

Students who are considering a major in mathematics **should work closely with the mathematics and counseling faculty of their college to design a program of courses in preparation for transfer to a university.** This should be done as soon as the student recognizes the goal of completing a mathematics major.

Initially the student should become familiar with requirements for majoring in mathematics at potential transfer universities. **Beware: Requirements for a mathematics major may differ significantly among the universities being considered.** The student should use available current catalogs, mathematics department websites, and other resources such as the ASSIST website to learn more about transferring and requirements for a mathematics major. The student should be encouraged to discuss choices with counselors and mathematics instructors and may find it helpful also to contact faculty or program advisors at a university's mathematics department to discuss any potential problems with articulation there.

General Education: A student should take as many lower division mathematics courses required for a major in Mathematics as possible before the transfer. If necessary, the student should take only the minimum of lower division General Education requirements for transfer.

Mathematical Maturity: Junior-level university mathematics majors are expected to read and write proofs of various types and levels of sophistication. This is referred to frequently as mathematical maturity. There are many levels of mathematical maturity, but junior-level mathematics majors are expected to perform at a level of maturity distinctly above that of lower division students.

Some university mathematics programs develop and certify mathematical maturity through a specific lower or upper division course with an emphasis on proof writing. Other programs provide the opportunity to develop mathematical maturity in the context of lower-division courses such as discrete mathematics or linear algebra.

In any case, prior to transfer, **the student should work to develop familiarity with proofs.** How this work will be received at a university varies from school to school. The student should consult with a transfer university's faculty or program advisor as early as possible for specific information and recommendations regarding mathematical maturity.

SPECIFIC RECOMMENDATIONS:

Geometry: The student should be familiar with geometric concepts including proofs at least at the level usually treated in high school geometry courses. This might be developed through a single course or included as part of an analytic geometry and calculus course and/or through an understanding of linear transformations in linear algebra.

Calculus: Ideally, the student should have completed the full calculus sequence (including infinite series and an introduction to the calculus of several variables) prior to transfer. This generally should take 3 semesters or 4-5 quarters. There are often different approaches taken during the first year calculus course. When the student cannot take the full calculus sequence prior to transfer, s/he should take at least one full year (2 semesters or 3 quarters) of a scientific / engineering style calculus course at the same institution. Splitting the first year of calculus can make articulation more difficult.

NON-CALCULUS COURSES

Linear Algebra: The student should take a course in linear algebra at least at the level of matrix algebra. At the university level this course is often a prerequisite for advanced courses. Some universities make linear algebra a key part of sophomore level course work while others have no formal course in linear algebra in the lower division. Depending on the university chosen, the process and result for transferring a linear algebra course taken at a community college may differ substantially. Nonetheless, **taking a linear algebra course before transfer is recommended without regard to how the course may be treated by the university after transfer.** The student should consult with the chosen transfer university's mathematics faculty or program advisor as early as possible for more advise on linear algebra courses.

Computer Programming: Students should have competency in a computer programming language.

Differential Equations: A differential equations course is required lower division course work at some universities, while at others a more sophisticated first course in differential equations is required at the junior level. Moreover, the mathematics major option for prospective high school mathematics teachers often does not require a course in differential equations. Depending on the university and the mathematics program chosen, the process and result for transferring a differential equations course taken at a community college may differ substantially. Despite these considerations, **students are encouraged to take a course studying differential equations before transfer.** The student should consult as early as possible with the chosen transfer university's mathematics faculty or program advisor for more advise on differential equations courses.

Statistics: A statistics course is a lower division requirement for a mathematics major at some universities. However at others, statistics is not required at all or is required as a more sophisticated upper division course. Depending on the university and the mathematics program chosen, the process and result for transferring a statistics course taken at a community college may differ substantially. Thus, **the student should consider taking a course in statistics being aware of the different levels of acceptance it may receive.** The student should consult as early as possible with the chosen transfer university's mathematics faculty or program advisor for more advise on statistics courses.

Computer Programming: Knowledge of computers is required at varying levels for a university mathematics major. Therefore, **the student should consider taking a computer course before**

transfer that develops competency in a computer programming language including the construction of algorithms.

Courses That Use Mathematics: At some universities, the mathematics major requires course work in a separate discipline that uses mathematics, such as physics, chemistry, or economics. These courses may also fulfill parts of general education requirements. To avoid a possible mismatch in course work between two schools, **the student should try to take full year applications courses for science majors before transfer.** However, the student should also consider, with advise from counselors and instructors, deferring a calculus-based physics course until the student has completed at least one year of calculus.

SUMMARY OF ADVICE:

The student should

- ▶ Work closely with the mathematics and counseling faculty of the community college to design a program of courses in preparation for transfer to a university
- ▶ Take as many lower division mathematics courses required for a major in Mathematics as possible.
- ▶ Work to develop familiarity with proofs.
- ▶ Be familiar with geometric concepts including proofs at least at the level usually treated in high school geometry courses.
- ▶ Complete the full calculus sequence (including infinite series and an introduction to the calculus of several variables) or at least one full year (2 semesters or 3 quarters) of a scientific / engineering style calculus course at the same institution.
- ▶ Take a linear algebra course. (Recommended)
- ▶ Take a differential equations course. (Encouraged)
- ▶ Consider taking a course in statistics.
- ▶ Consider taking a computer course that develops competency in a computer programming language including the construction of algorithms.
- ▶ Try to take full year applications courses for science majors.
- ▶ Consider deferring a calculus-based physics course until the student has completed at least one year of calculus.