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Lawrence Pitts, University of California Academic Council Chair
Robert Cherny, CSU Academic Senate Chair
Kate Clark, Academic Senate for California Community Colleges President

INTERSEGMENTAL MAJOR PREPARATION ARTICULATED CURRICULUM

March 9, 2004

Dear Mathematics Department Chairs,

The Intersegmental Major Preparation Articulated Curriculum (IMPAC) project is a unique intersegmental, faculty-designed and faculty-run project to ensure that students transferring from the community colleges to UC and CSU are prepared for work in their chosen major and can avoid having to repeat coursework. The project is an initiative of the Intersegmental Committee of Academic Senates (ICAS) representing the faculty of the University of California, California State University, and California Community Colleges, through their respective Academic Senates.

Over the past two years, mathematics faculty members from across the state involved with IMPAC have developed two related memoranda to help prospective mathematics majors plan their time effectively while attending a California community college. One memo is directed to staff at the community colleges that advise these students, while the other is addressed directly to the students.

These two memoranda are enclosed with the intention that you will make and distribute copies to appropriate students, faculty, and staff. Keep them on file and use them as suitable; they should be helpful in advising transfer mathematics students for many years to come. If you have any questions or comments about these memos or IMPAC, feel free to contact Professor Martin Flashman, the IMPAC lead faculty member for Mathematics, by mail, phone, or e-mail.

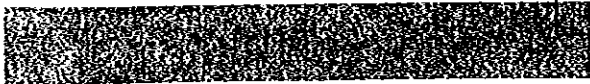
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Sincerely,

Julie Adams
Executive Director

Enclosures

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INTERSEGMENTAL MAJOR PREPARATION ARTICULATED CURRICULUM

MEMORANDUM ON ADVISING PROSPECTIVE MATHEMATICS MAJORS

To: Mathematics and Counseling Faculty at Two-year Colleges
From: The Intersegmental Major Preparation Articulated Curriculum (IMPAC) Mathematics Discipline Group
Re: Advising Prospective Mathematics Majors

As a result of the consultations with mathematics departments of the University of California, the California State University, and the California State Community Colleges, the Mathematics Discipline Group of IMPAC provides the following recommendations to assist community college students prepare for transfer as mathematics majors.

GENERAL RECOMMENDATIONS

Students who are considering a major in mathematics *should work closely with the mathematics and counseling faculty of their college as soon as possible to design a program of courses in preparation for transfer to a university.*

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 current catalogs, mathematics department web sites, and other resources such as the ASSIST web site [<http://www.assist.org>] to learn more about transfer requirements for a mathematics major. Encourage students to discuss choices with counselors and mathematics instructors and to contact a university's mathematics faculty or program advisors to discuss any potential problems with articulation there.

A student should take as many lower division mathematics courses required for a major in Mathematics as possible before the transfer.

General Education: In order to complete lower division requirements in mathematics, the student should take only the minimum number of lower division General Education requirements needed 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. 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.

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Calculus: There are often different approaches taken during the first year calculus course. 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. 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 result in missing concepts and may make articulation more difficult.

NON-CALCULUS COURSES

Linear Algebra: Students should take some course that covers 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. Despite these considerations, *students are encouraged to take a course studying linear algebra before transfer.* The student should consult with the chosen transfer university's mathematics faculty or program advisor as early as possible for more advice on linear algebra courses.

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 advice on differential equations 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.*

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 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 advice on statistics courses.

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 advice 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 as soon as possible 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. (Encouraged)
- Take a differential equations course. (Encouraged)
- Consider taking a computer course that develops competency in a computer programming language including the construction of algorithms.
- Consider taking a course in statistics.
- 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.



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INTERSEGMENTAL MAJOR PREPARATION ARTICULATED CURRICULUM
ADVISORY MEMORANDUM TO PROSPECTIVE MATHEMATICS MAJORS

To: Students at Community Colleges Considering a Major in Mathematics
From: The Intersegmental Major Preparation Articulated Curriculum (IMPAC)
Mathematics Discipline Group
Re: Advice in Preparing for a Major in Mathematics

As a result of consultations with mathematics departments of the University of California, the California State University, and the California Community Colleges, the Mathematics Discipline Group of IMPAC provides the following recommendations to assist community college students preparing for transfer as mathematics majors.

GENERAL RECOMMENDATIONS

Since you are considering a major in mathematics, *you should work closely with the mathematics and counseling faculty of your college as soon as possible to design a program of courses in preparation for transfer to a university.*

Initially you should become familiar with requirements for majoring in mathematics at universities to which you may transfer. It is important to note that the requirements for a mathematics major may differ significantly among the universities you are considering. Use current catalogs, mathematics department web sites, and other resources such as the ASSIST web site [<http://www.assist.org>] to learn more about transfer requirements for a mathematics major. Discuss your choices with your counselors and mathematics instructors. Contact a university's mathematics faculty or program advisors to discuss any potential problems with transferring courses there.

You should take as many lower division mathematics courses required for a major in Mathematics as possible before you transfer.

General Education: In order to complete lower division requirements in mathematics, take only the minimum number of lower division General Education requirements needed 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, *you should work to develop familiarity with proofs*. How this work will be received at a university varies from school to school. You 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: *You should be familiar with geometric proofs and concepts, at least at the level usually treated in high school geometry courses.* This familiarity might be developed through a single geometry course or as part of other courses such as analytic geometry, calculus, or linear algebra courses.

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Calculus: There are often different approaches taken during the first year calculus course. Ideally, *you 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 (4-5 quarters). When you cannot take the full calculus sequence prior to transfer, you 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 between courses at different colleges can result in missing concepts and may make articulation more difficult.

NON-CALCULUS COURSES

Linear Algebra: You should take some course that covers 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, the process and result for transferring a linear algebra course taken at a community college may differ substantially. Nonetheless, *you are encouraged to take a course studying linear algebra before transfer.* You should consult with your chosen transfer university's mathematics faculty or program advisor as early as possible for more advice on linear algebra courses.

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. However, 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, the process and result for transferring a differential equations course taken at a community college may differ substantially. Despite these considerations, *you are encouraged to take a course in differential equations before you transfer.* You should consult with your chosen transfer university's mathematics faculty or program advisor as early as possible for more advice on differential equations courses.

Computer Programming: Knowledge of computers is required at varying levels for a university mathematics major. Therefore, *you should consider taking a computer course that develops competency in a computer programming language as well as the construction of algorithms before you transfer.*

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 you choose, the process and result for transferring a statistics course taken at a community college may differ substantially. Thus, when *you consider taking a course in statistics you should be aware of the different levels of acceptance it may receive.* You should consult as early as possible with your chosen transfer university's mathematics faculty or program advisor for more advice on statistics courses.

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, *you should try to take full year applications courses for science majors before you transfer.* However, *you should also consider, with advice from your counselors and instructors, deferring a calculus-based physics course until you have completed at least one year of calculus.*

SUMMARY OF ADVICE

- Work closely with the mathematics and counseling faculty of your college as soon as possible 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. (Encouraged)
- Take a differential equations course. (Encouraged)
- Consider taking a computer course that develops competency in a computer programming language including the construction of algorithms.
- Consider taking a course in statistics.
- Try to take full year applications courses for science majors.
- Consider deferring a calculus-based physics course until you have completed at least one year of calculus.