Bakersfield College
Mathematics Program Review
Fall 1998/Spring 1999

Program Review Team
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       Department Chair, Philosophy
Member - Dr. Janice Toyoshima
       Division Chair, Science, Engineering and Agriculture
Ex-officio Member - Dr. Robert Allison
       Vice president, Instruction

Resource Team from the Mathematics Department
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# Descriptive Information

<table>
<thead>
<tr>
<th>Department</th>
<th>Mathematics</th>
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<tbody>
<tr>
<td>Date of Evaluation</td>
<td>Fall 1998/Spring 1999</td>
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## Department or Program Description

Mathematics is a rapidly growing discipline whose concepts and applications play an ever-increasing role in virtually all aspects of modern life. Mathematics is an essential intellectual tool used by all students majoring in physics, chemistry, biology, computer science, the earth sciences, all areas of engineering, economics, psychology, and the social sciences. All majors have mathematics requirements which help develop not only skills necessary in those disciplines, but also help to cultivate cognitive skills and critical thinking useful in all aspects of life.

The courses we offer range from the most elementary courses in basic arithmetic through differential equations and linear algebra. Our curriculum is designed to provide all students with the mathematical knowledge and skills they will need for further study whatever their area of specialization. Our calculus sequence provides a sound background for further study leading to bachelor degrees in mathematics, the sciences, and engineering fields.

## Physical Resources:

### Facilities

- Math Science (MS) Building
- Language Arts (LA) Building
- Shirley Trembley computer labs (LA 107 B & LA 107C)
- Distance Learning classroom in L 147
- The Delano Center
- Ridgeview High School
- Weill Institute
- Centennial High School
- Tehachapi High School

### The Math Learning Center

Housed in the Student Services building, provides an open entry/open exit self-paced program in developmental math. Courses offered there range from basic arithmetic through intermediate algebra.

### Drop-in Tutoring Center

Housed in MS 3, offers free tutoring in a wide range of math courses for Bakersfield College math students.

### The Math Commons

Housed in MS 107C, provides a common work area for faculty to prepare materials for classes as well as provide a meeting place for various department committees. It contains faculty mailboxes, bulletin boards, supplies, a departmental copy machine, a fax machine and a NCR scanner.

### On-line Courses

The department currently has six math classes that are taught via the Internet. See attached document on online courses.

## Computer Equipment

Each faculty member has a Pentium system. Most statistics classes are scheduled in the Shirley Trembley computer labs and associated technologies are an integral part of our statistics curriculum.
Most of the Calculus classes, differential Equations and Linear Algebra utilize computer algebra systems. The prealgebra/algebra sequence utilizes interactive tutorial software to supplement instruction. Mathematics for Liberal Arts Majors utilizes a multimedia format of instruction.

**Calculators:**
Almost all math courses make use of calculators

<table>
<thead>
<tr>
<th>Current Issues and Concerns</th>
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<tbody>
<tr>
<td>• Curriculum changes are occurring nation wide as a result of the ongoing Calculus reform movement. These reforms have been supported by the national Science Foundation (NSF), the American Mathematical Society (AMS) and the Mathematical Association of America (MAA).</td>
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<td>• Related reform movements are having an impact on curriculum of precalculus courses.</td>
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<td>• The implementation of state wide mathematics standards will raise the level of mathematics accomplishment of graduating high school seniors. This will have an impact on the distribution of course offerings at Bakersfield College.</td>
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<td>• The entry requirement for agriculture majors at California State University system, has been raised to include Math C (Trigonometry) and Math 1 (Precalculus). This also has had an impact on the distribution of courses at BC.</td>
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<td>• The department has been offering interactive Television Courses since summer 1995, to Delano.</td>
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<td>• The department is offering six on-line courses via the Internet this semester and plans to expand this program in the following semesters.</td>
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<td>• The department has been offering cable TV classes since summer 1998.</td>
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<td>• The Math Learning Center is evolving to include all components of distance education, open entry/open exit self-paced program, cable television courses, on-line courses, in the developmental math sequence.</td>
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### Quantitative Information

<table>
<thead>
<tr>
<th>Instructional Departments and Programs</th>
<th>Number of full-time faculty</th>
<th>21</th>
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<tbody>
<tr>
<td></td>
<td>Number of part-time faculty</td>
<td>25</td>
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<tr>
<td></td>
<td>Total FTE faculty (FTEF)</td>
<td>34.94</td>
</tr>
<tr>
<td></td>
<td>Number of full-time classified employees</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Number of part-time classified employees</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Total FTE part-time classified employees</td>
<td>1.6</td>
</tr>
<tr>
<td></td>
<td>Total full-time equivalent students (FTES)</td>
<td>1123.17</td>
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<tr>
<td>FTES/FTE</td>
<td>32.15</td>
<td></td>
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<tr>
<td>Total number of students served</td>
<td>8556</td>
<td></td>
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<tr>
<td>Total cost (actual expenditures for year)</td>
<td>$1,387,669 + $106,534 = $1,494,203</td>
<td></td>
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<tr>
<td>Cost/FTES</td>
<td>$1,235.50 + $94.85 = $1329.85</td>
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### Qualitative Information

<table>
<thead>
<tr>
<th>Program Purpose</th>
<th>Our curriculum is designed to provide all students with the mathematical knowledge and skills they will need for further study whatever their area of specialization.</th>
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<tbody>
<tr>
<td>Transfer</td>
<td>Mathematics is an essential intellectual tool used by all students majoring in physics, chemistry, biology, computer science, the earth sciences, all areas of engineering, and economics. Our calculus sequence provides a sound background for further study leading to bachelor degrees in mathematics, the sciences, and the engineering fields.</td>
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<tr>
<td>General Education</td>
<td>Mathematics is a rapidly growing discipline whose concepts and applications play an ever-increasing role in virtually all aspects of modern life. All majors have mathematics requirements which help develop not only skills necessary in those disciplines, but also help to cultivate cognitive skills and critical thinking useful in all aspects of life.</td>
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<td>Remedial</td>
<td>Our department has a strong developmental program, utilizing diverse modalities of instruction. In addition to the traditional classroom lecture format, the Math Learning Center offers self-paced instruction, online courses offer asynchronous distance learning instruction, interactive television courses between Delano and Bakersfield and cable television courses offer many more modes of distance learning instruction. We are in the process of integrating these various modes of instruction to facilitate our students’ success.</td>
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<thead>
<tr>
<th>Relationship to College Mission</th>
<th>The mission of our department is to focus on student success by providing quality instruction in environments that value and support learning, teaching, and scholarship.</th>
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<tr>
<td></td>
<td>Offering courses in various ways (e.g., open-entry, open-exit, self-paced courses in the Math Learning Center, Cable TV courses, evening classes, Saturday classes, Internet courses, Inter session courses, etc.) not only makes it easier for students to fit courses into their busy schedules, but also addresses students' diverse cognitive learning styles.</td>
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<td>The Math Department is working on plans to integrate these various ways our courses are being offered, so that our students will be able to utilize more than one instructional modality in their studies. Psychologists have shown that utilizing multiple modes of instruction results in a much more effective learning environment than utilizing a single instructional mode. Different instructional modes help students with diverse cognitive styles to succeed.</td>
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<td></td>
<td>Our Drop-in Tutoring Center (DIT) allows students to get tutoring when they need it. The math department is exploring various ways this valuable student resource can in the future be supported to a higher degree than is now possible. DIT has been highly successful and useful</td>
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</table>
to our students, and should be funded to allow for increased staffing.

We measure our success by engaging in an active program of self-assessment, educational and departmental research, and modify our programs to meet the changing needs of our students and community.

The math department has not aggressively pursued quantitative self-assessment in terms of student outcomes. However, the department has kept in touch with national changes in mathematics curricula and with local changes in student and community needs, and revised course offerings and instructional methodologies accordingly.

For example:

- Our 21st century students will need a somewhat different mathematical education than the traditional 19th century curriculum provides. With the evolution of new technologies, a strong mathematical background will be increasingly essential in the future job markets, and our department is dedicated to helping students to meet this challenge. All the math courses have integrated appropriate technologies that continue to evolve.

- In response to the changing and diverse student needs, the Mathematics Department is constantly incorporating new class offerings. For example, in the last three years, the department has
  - increased the number of interactive TV classes
  - established an instructional television program
  - established an on-line program
  - established a weekend program

| Affirmative action goals and progress | The math department currently has three (14.3%) faculty of non European heritage. Using the larger definition of diversity, the mathematics department presents to students people of diverse ethnic backgrounds doing mathematics. Using the legal definition of historically under-represented groups, the math department has 10 (47.6%) female faculty, but the department remains under represented in terms of Hispanics, and Blacks. |

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Qualitative Information (con’t.)

- **Level of service to other college departments/programs:**

  The mathematics department provides an essential general education requirement for all departments and programs. As technology becomes increasingly important in our society, the needs for mathematical skills will likewise increase.

  Mathematics majors compromise less than 1% of students taking mathematics courses at Bakersfield College in any given semester. This implies that our department's activities are more than 99% dedicated to serving other college departments and programs.

- **Community and student need:**

  As technology becomes increasingly important in our society, the needs for mathematical skills will likewise increase. A strong mathematical background will be increasingly essential in the future job markets, and our department is dedicated to helping students to meet this challenge.

  We are expanding our offerings to outlying areas previously inadequately served via cable television classes, interactive television classes, and Internet classes.

  On campus offerings have expanded to include late afternoon sections and weekend sections to better fit our students schedules.

  We are also offering classes during the winter inter-session that will help students hone mathematical skills necessary
• Projection of future enrollment/need:

Bakersfield College projects significant growth in the next few years. The increase in demand for mathematics courses is expected to exceed this overall projected growth. This is due to an increase in the mathematical requirements of the transfer institutions as well as the actual increase in the number of students enrolling at Bakersfield College. As attendance costs increase in the UC and CSU systems, a continuing increase in community college enrollments is expected.

• Comparison with similar departments/programs at other community college:

The Bakersfield College mathematics program is very similar to those of all other community colleges in both the scope and breadth of courses offered. One area where BC has excelled relative to other community colleges is in online mathematics instruction; no other community college offers as many math courses in this mode.

(See the attached "Comparison with Programs at Other Institutions")

• Advisory committee recommendations:

We have no advisory committee.

• Staff development needs/activities:

Funding to attend conferences.
Training in the use of technology.
Training in successful classroom strategies to improve student outcomes.

Program Outcomes

<table>
<thead>
<tr>
<th>Transfer Programs</th>
<th>Content mastery (from pre- and post-test data, results of standardized tests, licensure examination pass rates, etc.)</th>
<th>Currently for our transfer courses (Statistics, Business Calculus, Math Analysis, Calculus I II &amp; III) we don’t have standardized exams. The content mastery is assessed by the individual instructor, via various tests and other assessment instruments. A comprehensive final exam is required for all students in all mathematics courses.</th>
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<tbody>
<tr>
<td>Student satisfaction</td>
<td>A Student Satisfaction study during the Fall 1997 revealed that 90% of the students were satisfied with course content, instruction, course offerings, and accessibility of instructors within the department. This indicates a very high level of student satisfaction for our program. (See the attached &quot;Student Satisfaction Survey&quot;)</td>
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<td>Retention rates</td>
<td>The department retention rate was 66.6% as reported in the Department Analysis '96-'97 document, January '98.</td>
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Transfer rates

Transfer rate data by department is not available.

Performance/success of transfer

Although a formal study of transfer success rates is beyond the financial and physical capabilities of the department, we continue to hear informally that our students are, in general, more successful at transfer institutions than are students who began there as freshmen.

Program Outcomes (con’t.)

Program Needs

PERSONNEL

Considering current and future needs, we will require a minimum of four new full time positions, in addition to replacing four anticipated retirees.

- In Fall ’98 we were forced to turn away approximately 300 students due to insufficient staffing.
- Enrollments are projected to increase over the next four years.
- Our pool of part-time instructors has been steadily decreasing, which has forced us to close sections. There simply aren’t sufficient numbers of people qualified to teach mathematics locally to allow us to increase our dwindling pool of adjunct faculty.

Although we would like to increase our pool of adjunct faculty, it hasn’t been possible to keep it from decreasing. CSUB has no masters program in mathematics, which has resulted in a lack of qualified adjunct mathematics faculty in Bakersfield.

BUDGET

Increase in our supply and equipment budget

- Now that almost all faculty have printers in their offices, there is a regular need for printer cartridges. The department currently has no funds available to deal with this added expense.
- Many of our online courses make extensive use of the department fax machine. This results in the frequent need for new cartridges and service for the machine ($300 per year).
- The use of graphing calculators is becoming an integral part of our mathematics program. The department needs at least one classroom set of graphing calculators available ($4000—one time expenditure).
- Computer hardware needs periodic upgrading, along with software. This is important for both the labs in LA 107B and LA 107C, but also for individual instructor’s computers.
FACILITIES

Physically bring together the various math department facilities into one central location.

Currently the math department classrooms, labs, offices, Learning Center, and Drop in Tutoring Center are scattered all over the campus. A more centralized location for all these departmental resources would much better serve our students' needs. We would like to expand the Learning Center to include the Drop-In Tutoring program and the cable TV course.
Math Online Courses

The math department offered three online courses (Math 50, Math A and Math D) in Fall 1997. In Spring 1998, the online program expanded to include Math 6A, 6B, 6C and 22. In Fall 1998, Math 50 and Math A were retracted from the online curriculum so that the department could revamp the courses with the feedback received from students, and faculty teaching those courses. Math 2 was also added to the online curriculum.

In Fall 1997, the maximum student enrollment was set at 25 adhering to the campus wide decision to keep the classes small. Due to retention issues, each faculty was given the opportunity to determine if they wanted to increase the maximum enrollment in their class beyond 25. Currently the total maximum enrollment in the six online courses is 215, averaging 35 students per class.

In Spring 1998 an Internet Math Courses Committee (IMC²) was formed to discuss the different issues related to online math instruction. Some of the outcomes from the discussions were:

1. The online courses at the very least should have their final exam proctored.

2. Online courses should not take instructors away from teaching traditional classes, since the department has had a difficult time covering some of the developmental and general education courses.

3. Evaluation of our online program must be an ongoing process.

The first point has already been implemented; all online classes require proctored final exams. Some of the courses have two or more proctored exams. The second point has also been implemented. Out of the 26 units that have been offered online, only six are part of faculty loads, while the remaining 20 are extra-pay units.

IMC² did not meet during Fall 1998. The committee will continue to meet in Spring 1999 and will develop an assessment plan for the online program, as well as address other issues like whether the department needs to reassign faculty teaching the online courses as part of load to developmental or transfer courses.

The additional cost in supplies for the online program has been $300 per year. This money is to purchase toner cartridges for the fax machine, which is used by the online courses faculty to receive student assignments.
Appendices
Comparison with programs at other Institutions

The Bakersfield College Mathematics program is quite similar in scope to that of other California community colleges. Discussion with colleagues at conferences indicates that all have essentially the same problems and concerns. The progress we are making in the use of technology exceeds that of other schools, many of our colleagues are envious of the Shirley Trembley Math Centers. The faculty at Bakersfield College have hosted the faculty at California State University, Bakersfield, the Kern County High School mathematics instructors, and many others from colleges and high schools around the state to insure that we are informed about program changes considered (and tried) at other institutions.

Of the 107 California Community Colleges, we randomly selected 10 colleges and compared our program to theirs. The colleges were compared by catalogue offerings.

Modern College Arithmetic \ Pre-Algebra (Math 50)
All of the surveyed colleges offered this course. Hartnell offers only the Pre-Algebra part of the course. Like us, many of the colleges offer this class in a self-paced open-entry alternative.

Elementary Algebra (Math A)
All of the surveyed colleges offered this course. In addition to an elementary algebra course, West Valley College offers an Elementary Algebra-Review and also a course titled “Algebra and Geometry for Everyday Life.” Two of the colleges offer beginning algebra as a one semester course and also as a two semester course. Like us, many of the colleges offer this class in a self-paced open-entry alternative.

Geometry (Math B)
Half of the surveyed colleges offered this course (5 had a geometry course and 5 did not offer a geometry course). At Las Positas College geometry is offered only through a learning center lab.

Plane Trigonometry (Math C)
All of the surveyed colleges offered this course. At Las Positas College trigonometry can be taken as a stand alone course or in combination with pre-calculus. At West Valley College and Santa Rosa Junior College trigonometry is only offered in combination with pre-calculus.

Intermediate Algebra (Math D)
All of the surveyed colleges offered this course. In addition to an intermediate algebra course, West Valley College offers an Intermediate Algebra-Review. Two of the colleges offer intermediate algebra as a one semester course and also as a two semester course. Like us, many of the colleges offer this class in a self-paced open-entry alternative.
Math Analysis (Math 1)
All of the surveyed colleges offered this course. At Las Positas College pre-calculus can be taken as a stand alone course or in combination with trigonometry. At West Valley College and Santa Rosa Junior College pre-calculus is only offered in combination with trigonometry.

Basic Functions & Calculus for Business (Math 2)
Six of the surveyed colleges offered this course.

Analytical Geometry & Calculus I, II, III (Math 6A through 6C)
Ordinary Differential Equations (Math 6D)
Introduction to Linear Algebra (Math 6E)
All of the surveyed colleges offered this course. All of the colleges surveyed have calculus sequences that are similar to ours.

Elementary Probability & Statistics (Math 22)
Many of the colleges surveyed have a statistics class that does not include the amount of probability that is included in our course. Many of the schools offer this course over 2 semesters. Many of the colleges offer a supplemental course in doing a statistical project. West Valley College offers a course titled “Stats for Everyday Life.”

Liberal Arts Mathematics (Math 16)
Nearly all of the colleges offered courses that seemed similar to our course. Palomar College offered this course for general Liberal Arts Students and also a 2 semester course for students wishing to teach elementary school. Many of the colleges offered a 2 semester course for elementary education.

Graphing Calculators, Derive, and Maple.
Many of the other colleges are also attempting to incorporate courses that supplement their regular program. Classes that instruct students on the use of technology are being offered at many of the colleges surveyed.

Other Courses (not offered at Bakersfield College)
Discrete Mathematics and Finite Mathematics are courses that are commonly taught at other colleges that are not currently taught at BC.

Computer Programming courses were also taught through the math department at several of the colleges. (Pascal, Basic, and FORTRAN) These classes are taught at BC through the Computer Studies department.

Logic is taught through the math department at several colleges. At BC Logic is taught through the Philosophy department.

Several colleges offered a class titled “Math for Medications.” This type of course is incorporated into the nursing program at BC.
Surveyed Colleges

Las Positas College
3033 Collier Canyon Rd
Livermore Ca 94550

Lassen College
P.O. Box 3000, Hwy 139
Susanville Ca 96130

West Valley College
14000 Fruitvale Ave
Saratoga Ca 95070

Chabot College
25555 Hesperian Blvd
Hayward Ca 94545

College of Alameda
555 Atlantic Ave.
Alameda Ca 94501

Santa Rosa Junior College
1501 Menidocino Ave
Santa Rosa Ca 95401

Hartnell College
156 Homestead Ave
Salinas Ca 93901

Palomar College
1140 W. Mission Road
San Marcos Ca 92069

Saddleback College
28000 Marguerite Pkwy
Mission Viejo Ca 92692

Modesto Junior College
435 College Ave.
Modesto Ca 95350-5800
### Student Satisfaction

| The math department conducted a Student Satisfaction study during the Fall 1997 semester. Classes were randomly selected from all math departments courses (including those taught by adjunct faculty). Efforts were made to insure the make-up of the sample reflected our diverse student population. | About 90% of the students responded that they were satisfied with course content, instruction, course offerings, and accessibility of instructors within the department. This indicates a very high level of student satisfaction for our program. See attachment for details. |

### Student Satisfaction Survey

The Mathematics Department during the Fall 1997 semester solicited student opinion as to the effectiveness of its program, the level of instruction, and the availability of staff to provide extra help when needed. A stratified random sampling of classes were selected from all math department courses (including those taught by adjunct faculty). The students were sampled to insure that the proportion of beginning algebra, intermediate algebra, etc. in the sample matched the proportion of beginning algebra, intermediate algebra, etc. in the population. Efforts were made to insure the make-up of the sample reflected our diverse student population.

The questions listed below are the ones pertinent to the study. In each case, students were asked to respond on a scale of one to five, where

1. strongly disagree  
2. mildly disagree  
3. neutral  
4. mildly agree  
5. strongly agree

Questions 2, 3, 5, and 6 are the ones of major concern; in many cases, the student is in no position to respond knowledgeably to the others.

1. The subject content of this course meets my needs.  
2. The instruction in this class has been very good.  
3. The instructor of this class has been accessible and willing to help when I have had a problem.  
4. The course offerings of BC’s Math Department meet my needs.  
5. Instruction within the Math Department is generally very good.  
6. Instructors within the Math Department are accessible and willing to help when students have problems.

Many students (about 17% of those surveyed) responded “3 - neutral” to the above questions. Many made written comments indicating that they were unsure about course offerings, instructors other than their own instructor, and instructor accessibility as they had never tried to
meet with their instructor; and therefore were marking “3 - neutral”. Students who marked neutral are neither satisfied nor unsatisfied with the math department, many of these students do not feel they are in a position to answer knowledgeably. The results below are percentages reported on the 83% of the surveyed students who responded with an opinion of satisfaction (4 - mildly agree and 5 - strongly agree) or an opinion of dissatisfaction (1 - strongly disagree and 2 - mildly disagree). The results are as follows.

1. 88.7% agreed that the subject content of the course they were taking met their needs. (n = 301)
2. 87.7% agreed that the instruction in their class had been very good. (n = 357)
3. 92.9% agreed that the instructor in their class had been accessible and willing to help when they have had a problem. (n = 364)
4. 89.3% agreed that the course offerings of BC’s Math Department met their needs. (n = 319)
5. 91.7% agreed that instruction within the Math Department is generally very good. (n = 302)
6. 92.3% agreed that instructors within the Math Department are accessible and willing to help when students have problems. (n = 324)

In summary, about 90% of the students responded that they were satisfied with course content, instruction, course offerings, and accessibility of instructors within the department. This indicates a very high level of student satisfaction for our program.