MIDDLESEX COMMUNITY COLLEGE

ACADEMIC DEPARTMENT REVIEW

FOR

MATHEMATICS DEPARTMENT

2007 – 2009

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MIDDLESEX COMMUNITY COLLEGE

Academic Department Review

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Section I: Introduction
This is an opportunity to provide background or contextual information, set goals for the departmental review and/or include any other introductory information that the committee believes will be helpful to the reader. Include information about previously completed departmental reviews, such as findings, improvements, and unfinished items.

In 1998, the Math department began its first Program review, starting with the Developmental courses. At the completion of that review, the department continued the process with a review of the Upper Level courses. This program review will be a single review of the course offerings of the entire department. We will again attempt to evaluate the breadth, sequence and effectiveness of the courses offered by the department. We shall look back at what we have accomplished since the previous reviews, and suggest recommendations for improvement so that the department and the college can better meet the needs of our students.

Since the completion of the first program review, the department has completed or made improvements in the following areas:

- Increased the number of full-time faculty.
- Evaluated the CPT results for the combined accelerated courses, to see if these courses are serving their purpose.
- Prepared a CPT pre-test to allow students to practice before they take the Placement test. This is a current mini-grant which will continue this semester.
- Participated in AMATYC and NEMATYC conferences, and also have been presenters over the past 5 years.
- Assured that all full-time faculty members teach courses on the Developmental level on a regular basis.
- Improved the communication with adjunct faculty via Blackboard sites containing the materials for the course, and/or email lists.
- Developed a new course for those students who do not need all of the materials in the Fundamentals course. This new course briefly reviews some of the materials in the Fundamentals course, and then moves the students through the materials in Algebra 1.
- Piloted a lab component to the Fundamentals course in the Spring 2008 semester.
- Increased our use of the available technology. (BlackBoard, MyMathLab, Excel and "smart classrooms")
- Participated in the Lowell Civic Collaborative.
- Sought out sources of free technology (Texas Instruments) for the classrooms.
- Developed courses in response to student/program needs (e.g. Intro to Statistics; Elements of Math).
- Incorporated various national and regional initiatives into the curriculum.
    - Math Across the Curriculum - we are currently in the second year of a 3-year NSF grant to assist not only MCC but other schools in developing classroom materials.

- Learning Communities – in addition to the MAC materials, the math department is developing its first learning community along with the science and education departments for our elementary education students
- STEM
- Vertical Teaming
- 'MOD Squad' – Math on Demand – math department faculty assist faculty in other departments to present math related topics.
- Title III grant – Strategies for Student Success
- 100% Math Initiative – FIPSE grant in conjunction with other community colleges in the state.

All of these are ongoing and many are being regularly evaluated to see that they are indeed as successful as the department anticipated.

Section II: Mission and Goals

1. State the mission of the department/area. Please indicate if the mission statement is new or has been significantly revised as part of a prior departmental review process.

   The Math Department developed its first mission statement for the previous program reviews, and feels it is still appropriate:

The Mathematics Department of Middlesex Community College is:

- Determined to empower our diverse and culturally rich student body with a strong mathematical foundation by developing the students' analytical, problem solving and critical thinking skills;

- Dedicated to serving students with a variety of mathematical needs in a supportive environment through the use of up-to-date methodologies and curriculum;

- Committed to improving our students' mathematical literacy to ensure success in their future coursework, careers and life;

- Involved in the use of many methodologies to accommodate a variety of student goals, levels of students preparedness, learning styles and language proficiencies;

- Devoted to engaging students at all levels by implementing technology, group learning, real life examples, interdisciplinary approaches and/or alternative classroom methods such as self-paced instruction.

2. a. What is the relationship of the department/area's mission to the overall mission of the College as adopted by the Trustees and approved by the BHE?

The department's goals are in alignment with the overall mission of the college. Students are empowered with a strong mathematical foundation in analytical and critical thinking skills throughout the math sequence. These skills are important for transfer, employment, professional development and lifelong learning. Math students at MCC have the opportunity to attend classes that are offered using a variety of instructional methods, including interactive lecture, problem-based learning, self-paced and online. Many of these classes incorporate technology as an integral part of the learning process. The variety enables students to match their learning style and mathematical need with the type of class they attend.

b. Please explain what specific institutional goal(s) the department/area satisfies. You may include any goals referenced in the College Mission Statement or any goals illustrated in the Pillars of the College Mission Statement.

Math Dept. Correlation to Six Pillars of MCC's Mission Statement

A Dynamic Learning Environment
The department faculty continually strives to ensure student centered teaching and innovative instructional pedagogies. For many years technology, including graphing calculators and computers have been emphasized in many classes. Additional alternative innovations in pedagogy such as civic engagement projects and writing assignments are also used in many classes. Some examples are:

- Graphing calculator instruction/projects
- TI Smartview/TI Presenter
- MyMathLab
- Lowell Civic Collaborative/ Civic Engagement
- Fundamentals Lab Project
- Portfolios
- Grant initiatives
- Smart Classrooms with Internet connection

A Supportive and Caring Environment
Classes vary from 18 – 28 students depending on the level, with instruction tailored to the needs of individual students. Students are encouraged to seek additional assistance by taking advantage of meeting one on one with faculty, and using the free tutoring available at the Math Learning Centers on each campus. The staff of the Centers and the faculty work closely together to ensure that students are getting the support that they need.

Responsive Workforce Development
The math department has long worked with Business & Industry to assist in offering math courses as needed at various onsite locations. The department also has developed courses specific to needs of particular programs at the college. Specific examples include:

- Math Connections for Nursing program
- Elements of Math for teachers
- Business Precalculus
- Online courses
- Introduction to Statistics for health careers

Active Civic Engagement
The math department has been involved in the Lowell Civic Collaborative since its inception, and has incorporated it into classes on many levels – from Fundamentals of Math through Math Modeling and Precalculus.

Extended Learning Opportunities
Learning opportunities exist for students at all levels, both on and off campus. Students can take almost any math course online in order to complete a degree or certificate program. Our students are also involved in the Student Math League program sponsored by AMATYC (American Mathematics Association of Two Year Colleges). The department also participates in a STEM (Science, Technology, Engineering, Math) grant program, encouraging students in the pursuit of careers in these areas.

A Commitment to Excellence
Our faculty strives to help students achieve success and excellence both in the classroom and beyond. By both attending and presenting at regional and national conferences, our faculty takes advantage to the opportunity to share best practices with colleagues.
- Active in NEMATYC (New England Mathematical Association of Two Year Colleges) and AMATYC
- Student Math League
- Vertical Teaming
- Alg1/2, Fundies/Alg1 combo courses
- Pecalculus 1/2 for Business and Social Science combo course (new course introduced in Fall 2009)
- Online Teaching

Section III: Data
The Institutional Research Office will provide a significant portion of the data. Your committee is encouraged to request additional relevant information from Institutional Research and to develop and conduct alternative assessments as well. Some examples of assessments that the committee may choose to implement are student focus groups and/or student surveys. Input from relevant internal groups such as Advising, Admissions, and/or connected departments will also be necessary. Please include a copy of the data from Institutional Research and all departmentally-developed surveys or focus questions in the Appendix of the review.

3. **a. Please note important trends, patterns and issues that emerge through the enrollment, academic progress and retention data. (Data from Institutional Research Office)**

NOTE: Intermediate Algebra is at some times considered as a developmental course and sometimes an upper level course, depending on the program. In the previous Program Reviews, the department listed it with the upper level courses, and in the following assessments it has been included with the upper-level courses.

Data and charts supporting these conclusions are included in the appendix.

Question: Do students who take Intermediate Algebra (MAT100) prior to their first transferable math class perform on a par with classmates who did not require any remediation?

In order to answer this question, we looked at three groups of students from each of these two paths from Fall, 2002 through Spring, 2007 (Fall and Spring semesters only).
- Group 1: Students transitioning into Math Modeling (MAT120) from Algebra 2 (MAT080) versus those who placed into Math Modeling via examination
- Group 2: Students transitioning into Precalculus I for Business (MAT180) from Intermediate Algebra (MAT100) versus those who placed into Precalculus I for Business via examination
- Group 3: Students transitioning into Precalculus I for Science (MAT185) from Intermediate Algebra (MAT100) versus those who placed into Precalculus I for Science via examination

The following conclusions are supported at the $\alpha = .05$ level

Analysis of Success Rates in **Math Modeling** for Students with and without Prerequisite Developmental-Level Math Courses

Students who prepare for the college level class (MAT120) by completing a developmental-level prerequisite at Middlesex are as likely to earn a grade of A, B or C as are students who do not require any remediation.

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Students who prepare for the college level class (MAT120) by completing a developmental-level prerequisite at Middlesex are as likely to pass the course as are students who do not require any remediation.

Students who prepare for the college level class (MAT120) by completing a developmental-level prerequisite at Middlesex are as likely to fail or withdraw from the course as are students who do not require any remediation.

Analysis of Success Rates in **Precalculus I for Business** for Students with and without Prerequisite Developmental-Level Math Course, Intermediate Algebra

Students who prepare for the college level class (MAT180) by completing a developmental-level prerequisite (MAT100) at Middlesex are *as likely* to earn a grade of A, B or C as are students who do not require any remediation. That is, the math department has attained its goal of leveling the playing field for our developmental students in this particular class sequence.

Furthermore, students who prepare for the college level class (MAT180) by completing the prerequisite (MAT100) at Middlesex are actually more likely to pass the course than are students who do not require any remediation.

Students who prepare for the college level class (MAT180) by completing the prerequisite (MAT100) at Middlesex are less likely to fail or withdraw from the course than are students who do not require any remediation.

Analysis of Success Rates in **Precalculus I for Science** for Students with and without Prerequisite Developmental-Level Math Course, Intermediate Algebra

Students who prepare for the college level class (MAT185) by completing the prerequisite (MAT100) at Middlesex are *not* as likely to earn a grade of A, B or C as are students who do not require any remediation.

Students who prepare for the college level class (MAT185) by completing the prerequisite (MAT100) at Middlesex are as likely to *pass* the course as are students who do not require any remediation. However, significantly more of them pass with a grade of C- or lower.

Students who prepare for the college level class (MAT185) by completing a developmental-level prerequisite at Middlesex are as likely to fail or withdraw from the course as are students who do not require any remediation.

Retention rates:

The retention rate per course was found using the W grade as a guide to how many students have withdrawn from each course. The retention rates are calculated for each course offered in the Mathematics Department during the fall semesters of 2004, 2005, 2006 and 2007. The data does not take into account the percentage of students who continued on to a second mathematics course.

The average retention rate for the developmental courses, MAT 060, MAT 065, MAT 070, MAT 075 and MAT 080, is 83%. The average retention rate for the non-developmental courses, MAT 100, MAT 177, MAT 180, MAT 185, MAT 190, MAT 290 and MAT 291 is 80%. The average retention rate for program courses, MAT 077, MAT 085, MAT 120, MAT 130 and MAT 250 is 84%.

Completion rates:

Course completion is defined as a student who has completed the course with a passing grade (A through D-).

The data shows the following:

The course completion rates are for the developmental courses fall semesters only. These courses consist of Fundamentals of Mathematics MAT 060, Fundamentals/Algebra I MAT 065, Algebra I MAT 070, Algebra I/Algebra II MAT 075, Algebra II MAT 080. The overall average completion rate was 61%.

The course completion rates are for the fall semesters only. These courses consist of Intermediate Algebra MAT 100, Statistics MAT 177, Precalculus for Business MAT180, Precalculus for Science MAT 185, Precalculus II MAT 190, Calculus for Science MAT 290, Calculus for Science II 291. The overall average for the non-developmental courses was 63%.

The course completion rates are for the program courses fall semesters only. These courses consist of, Introduction to Statistics MAT 077, Math Connections MAT 085, Math Modeling MAT 120, Elements I MAT 130, Discrete MAT 250. The overall average for the program courses was 74%.

Enrollment:

 Total Mathematics enrollment from Fall 2004 to Fall 2007 has been stable with an average of 3825 each Fall term. Spring enrollment is not part of the data being studied. Within each course, the variation in the number of enrolled students is negligible; for example, Algebra II, our most attended course, varies between 22.6% and 23% of total Math enrollment.

However, there is a large variation in enrollment between courses. About three quarters of Math students enroll in courses ranging from Fundamentals of Math to Intermediate Algebra. Only about 10% enroll in Precalculus and Calculus courses and about 11% enroll in other courses ranging from Math Connections to Discrete Math.
A zero enrollment indicates that a course was not offered at the time. The Elements of Math course was added to the curriculum in 2005. Introduction to Statistics was first

offered in 2006. Precalculus I was offered as an evening or summer course. It was a combination between Precalculus I for Science and Precalculus I for Business. It was taken off the list in 2007 because it did not serve our students well.

b. Please comment on significant information that emerges from the Student Transfer and Employment Follow-up data. (Data from Institutional Research Office and Department Records)

N/A

c. Please summarize findings from student surveys, student focus groups, and/or other types of surveys and focus groups the Committee chose to undertake. (Data from surveys and/or questions developed by the Committee)

N/A

Section IV: Department/Area Analysis

Target Populations:
4. a. Is this department/area intended to serve a target population(s)? Please explain.

The math department is a service department which provides courses that help the student gain the appropriate mathematical skills needed for both our career and transfer programs.

b. Are there plans to market the courses in this department/area to any new or different groups that are not currently being served by this department/area? Please explain.

N/A

c. Are there plans to change or add to strategies currently in place to assess the department/area's fit with student interest and market demand?

The majority of our students take the math courses as required by their program; assessment in the area of market demand is often determined by the programs themselves, as they are our 'market'.

d. Are department/area faculty and staff currently working with the Academic Planning Center or other areas of the College to interest students in taking courses in the department/area? Describe these interactions and the roles that the parties play.

A full-time member of the math department serves on the Academic Advising Advisory Board and works closely with the advising center and registration of new and returning students. The board will also be involved in the implementation of the Advising aspect of the newly received Title III grant.

e. **Are there additional student recruitment/marketing efforts in which department/area faculty and/or staff would like to be involved? Please be as specific as possible.**

N/A

External Perspectives:

5. a. Based on a review of other college catalogs, list the colleges in our general area that have similar departments/areas and comment on significant differences from the MCC offerings that bear further exploration.

In comparing MCC with the other Massachusetts Community Colleges, it is apparent that the mathematics courses offered at all fifteen are very similar in both content and credit given. Furthermore, since the recent renumbering of all courses at Middlesex, the course numbers align well with similar courses at the other community colleges.

There are, however, some differences that bear further investigation and perhaps the implementation of course changes at MCC.

- **Prerequisites & College Credit**
  Four of the Community Colleges (Bristol, Greenfield, Massasoit and Springfield Technical) have a prerequisite of C- or better in a previous course to move on to the next course. The prerequisite of C- or better applies to both developmental courses and to college level courses. One school – Greenfield – adds an English prerequisite of College Writing Strategies for all of their college level mathematics courses. There is a statement in the Greenfield Academic Catalog that states that 'a final grade of D in developmental courses will not be awarded'.

  NOTE: Since this data was compiled, the department has implemented a prerequisite of a grade of C or better in sequential courses.

- **Trigonometry**
  Some of the community colleges offer Trigonometry as an independent course (offered for 1 or 2 credits). Massasoit also offers an Intermediate Algebra course with trigonometry. Discussion of this possibility at MCC is ongoing.

- **Graphing Calculator Courses**
  One school – Bristol – periodically offers a course entitled 'Problem Solving Using a Graphics Calculator'. Since far fewer schools (than noted in the 2001 – 2003 review) are offering a separate calculator course, we can perhaps surmise that more students are being exposed to this technology before they even arrive at the community college.

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- **Listing of Developmental vs. Upper Level Courses**

    Cape Cod Community College lists their developmental courses separate from the upper level mathematics courses. Some of the schools have also been discussing the feasibility of maintaining a separate developmental department with its own developmental course coordinator.

    NOTE: The FIPSE grant – 100% Math Initiative – recommended the establishment of a developmental math coordinator on each campus.

- **Quick Review Courses**

    Massasoit offers a series of 1 credit quick review courses. These include
    (1) Basic Math Review, which is a quick review of the fundamentals of arithmetic;
    (2) Basic Math Review of Fractions
    (3) Basic Math Review of Decimals.
    These 1 credit courses may be taken along with another mathematics course such as Introductory Algebra.

- **One credit courses**

    Springfield also offers a series of 1 credit developmental courses. Prealgebra is divided up into 3 segments and Introduction to Algebra is subdivided into six 1 credit courses.

b. Based upon the committee's knowledge of institutions beyond our geographical area that have exemplary departments/areas or are known for their 'best practices,' comment on significant similarities or differences from the MCC offerings that bear further exploration.

As part of a sabbatical project, Professor Ted Panitz of Cape Cod Community College did an extensive review of two-year (and four-year) colleges inside and outside of Massachusetts. The report that he issued in the Spring of 2007 speaks to this question.

Professor Panitz' purpose '…was to investigate successful/innovative programs at community colleges, 4 year colleges or universities that promote student retention and success in developmental math courses.'

Although restricted to developmental courses the study would apply to most of the courses we offer in the math department.

Most notable, among three pages of conclusions, might be the following, grouped into four areas as shown.

Extra Time on Task
1. Tutoring courses, 1-2 credit, taken in conjunction with credit courses that include study skills, counseling for math and test anxiety and advising.
2. Required tutoring outside of class; this was piloted in the Spring 2008 semester and is still being evaluated.
3. Extra class time for in-class tutoring – 4 -5 credit courses
4. Limit class size in DE courses. The current developmental cap at MCC is 22 students.

Flexibility in Course Structure
5. Offer courses in modular form.
6. Use multiple formats – didactic, modular, self-paced, CAI, variable credit. MCC offers didactic, self-paced, MyMathLab support and online.
7. Develop Learning Communities – MCC is involved in an NSF grant in support of Math Across the Curriculum. It is hoped that this initiative will lead into the development of Learning Communities.

Utilize and Support a Professional Faculty
8. Utilize full-time faculty in DE courses.
9. Use consistent formative evaluation based upon data collection and analysis.
10. Encourage ongoing communication among DE educators. The Department's course coordinators ensure that all faculty, especially new and adjunct faculty have a resource for the course. Participation in groups such as the statewide grant-funded 100% Math Initiative, NEMATYC and AMATYC also gives the department opportunity to work with other faculty on both a local and national level.

Disseminate Expectations and Know Our Incoming Students' Backgrounds
11. Communicate with local high schools. MCC has been involved for 4 years in a Vertical Teaming project within the City of Lowell. This program has faculty working from middle schools in Lowell, Lowell High School, MCC, and the University of Lowell to increase an understanding of the expectations and material covered at each level in order to provide a seamless transition between levels.

6. **Please describe mechanisms or procedures currently in place to monitor the currency and fit of the content areas and teaching methodology with the educational interests and needs of our students. Explain how these groups have contributed and/or impacted the department's/area's offerings.**

   a. **Relevant external parties, such as professional organizations, content skill standards, local, state, and national task forces, etc.**

The two most relevant professional organizations that the department works with very closely are NEMATYC (New England Mathematical Association of Two-Year Colleges) and AMATYC (American Mathematical Association of Two-Year Colleges). Members of the department not only regularly attend the conferences held by these organizations, but are very active with faculty serving as officers and board members, both in the local and national organizations.

Members of the department participated with all of the Community colleges across the state in the FIPSE grant '100% Math Initiative – Building a Foundation for Student Success in Developmental Mathematics'. Some recommendations made by this group were already in place at Middlesex or have been implemented since this document was published. They are:

- Varying classroom methodologies
- Selecting of textbooks by groups rather than individuals
- Adjusting instruction to meet a variety of learning styles
- Working with disabilities specialists
- Emphasizing the value of homework
- Establishing the position of Developmental Math coordinator on each campus (fulfilled by course coordinators)
- Provide Support Services

The board also recommended the development of learning communities defined as "cohorts of developmental mathematics students taking a set of courses together." This would involve participation from several areas of the college, a collaboration that has begun as a result of the NSF-funded MAC grant.

In its *Beyond Crossroads* document AMATYC has called for similar recommendations as those above. In addition they emphasize the importance of professional development of Faculty, promoting Quantitative Literacy for all students, incorporating workplace skills into all programs and the use of appropriate technology. The Math department will continue to look to this document for guidance as we work to improve student completion and retention rates.

    b. Relevant internal groups or individuals, such as other departments, programs or areas at the college that: (1) utilize your courses as prerequisites for their courses and/or program or (2) supply prerequisites for your courses.

As a service department, our courses are often used as prerequisites and/or corequisites for many departments. The most common are the sciences and business courses.

    c. Other populations (i.e., students, alumni, community members, cooperative education supervisors, practicum supervisors, service learning supervisors, community agencies).

N/A

Section V: Curriculum

Departmental Student Learning Outcomes (DSLOs)

7. a. Identify your Departmental Student Learning Outcomes

- o Students will be able to apply mathematical concepts and reasoning skills to model and solve real world problems.

- o Students will be able to communicate mathematically

- o Students will be able to formulate conclusions and judge the reasonableness of the conclusions by analyzing and interpreting data in a variety of forms including equations, tables and graphs

- o Students will be able to use a variety of approaches such as pattern recognition, modeling, logical reasoning, and estimation to solve mathematical problems and judge the reasonableness of their results.

- o Students will be able to use appropriate technology to enhance their mathematical thinking and understanding

b. Please describe your department's plan for ongoing, annual assessment of its DSLOs.

Random samples will be taken from 4 courses that we consider as "endpoints" for a majority of our students. The four courses from which artifacts will be collected are Algebra 2, Math Modeling, Statistics, and Precalculus 2, as they represent a broad spectrum of levels. We will select samples from Full-time, Part-Time, Day, evening and online sections. Once instructors provide us with a classroom set of artifacts, the assessment team will randomly select a few items from each of the sections.

We will be organizing the collection of the data at the first department meeting 9/29/09, and will complete the actual analysis at the first department meeting of the Spring 2010 semester.

c. If applicable, discuss any changes you have made to your DSLOs and/or the ways in which the courses in the department support those DSLOs since your last program review.

N/A

d. Map the way in which your department provides opportunities for students to progress towards achievement of each Departmental Student Learning Outcome, by noting in which courses the outcomes are **Introduced (I), Developed (D), or where students are expected to demonstrate Proficiency (P).**

Curriculum Map I:
Course Opportunities for Student Achievement of DSLOs

DSLO	Course
Communicate Mathematically	
Introduced	060;065;070; 077;
Developed	075;080;085;100
Proficient	120;130;131;177;180;185;190; 250;280;290;291

e. *Please comment on the **sequencing of opportunities** for students to develop and achieve each DSLO within the department, as noted on Curriculum Map I.*

Students begin the sequence at the point where they are placed by the Accuplacer exam or, in the case of transfer students, by previous work as indicated by their transcripts and approved by the department. Students in career programs must work through the level of MAT 075, 080, 085 or 077. The choice is dependent on the requirements of their specific program. Students in transfer programs must complete through at least MAT 120, 177 in general liberal arts programs, through the Precalculus/Calculus sequence for those majoring in STEM programs, or a specific course as required by their program.
  o Business transfer – Precalculus I for Business & Precalculus II
  o Education – Elements of Math I & II

A complete flow chart of the course sequencing is attached in the Appendix.

f. On the following pages, please indicate **how each DSLO is attained** and **how the attainment of each is assessed**. *If the strategy for attainment of a DSLO is contained within a particular course, please list the course first, with the relevant activity (or activities) listed next to each course. If there is nothing currently in place that is intended to provide for the attainment of a particular outcome or to assess the extent to which the outcome has been realized, please leave the appropriate space blank. The blanks will help to identify areas which need further development.*

DSLO I
Students completing significant coursework within the Math Department will be able to communicate mathematically.

Strategies for Attainment		Assessment Strategies
Course	**Activities**	
Algebra II MAT 080		Final Exam – Vocabulary Section
Math Modeling MAT 120	Oh What A Life Project	2-page Narrative
Statistics MAT 177	Graphing Calculator Project	Project or Paper
Pre-Calc II MAT 190	Graphing Calculator Project	Project or Paper

- Describe how this Departmental Student Learning Outcome is **assessed for proficiency** at the **department level**.

Algebra II, Math Modeling, Statistics, and Pre-Calculus II were selected as end courses which the department would assess to confirm that students are able to communicate mathematically. Dependent on the student's course of study / program, each of these courses could potentially serve as the last sequential course for students pursuing one of Middlesex's degree or certificate programs. Each of these courses is representative of the paths that Middlesex Community College students typically follow. Algebra II is the last mathematics course required for some of our certificate programs; Math Modeling is taken by our Liberal Arts Majors and is transferable as a college level mathematics course; a Statistics course is recommended for our Criminal Justice and Nursing majors; and our Pre-Calculus courses are provided for those students who plan to obtain a four-year degree in the areas of mathematics, science and technology.

The Algebra II final exam contains a section of vocabulary questions. This section will be assessed separately for this purpose. A student who passes this section of the exam with a C or better will be considered as developed in the DSLO of Communication.

The Math Modeling, Statistics and Precalculus projects will be assessed based on the written narrative in which students describe the research and calculations that they have made, and what conclusions they have drawn.

The papers/projects will be assessed as follows:

The paper/project of a student who is proficient in communicating mathematically will contain:

Content that is comprehensive, accurate, and persuasive. Major components of the project are stated clearly and are well supported. Research and computations are complete and address all of the project components.

The paper/project of a student who is approaching proficiency will contain:
The major project components but some of the content is missing, inaccurate, or not well supported by research.

The paper/project of a student who is not yet proficient in communicating mathematically will contain:
Content that is not comprehensive and/or not persuasive. Major points are addressed but not well supported.

- ***What does the department's data analysis reveal about student achievement of this DSLO within the department?***

This analysis has not yet been completed.

- ***What curricular and/or instructional changes are planned within the department as a result of this data (if any)? Consider***:

    - *The scope and sequence of Introductory, Developing, and Proficiency level student learning opportunities*
    - *The adequacy of the range of learning experiences and assessment methodologies that your department offers to meet student learning needs*

Changes will be considered and discussed within the department when the assessments above are completed

8. ***Institutional Student Learning Outcomes***
    (See **Appendix A** for detailed listing of MCC's Institutional Student Learning Outcomes)

    a. ***Please describe your department's plan for ongoing, annual assessment of MCC's ISLOs that are supported to proficiency within your department***.

    See #7b.

    b. ***If applicable, discuss any changes you have made to your department's support of MCC's ISLOs since your last program review.***
    N/A

c. As appropriate, map the way in which your department provides opportunities for students to progress towards proficiency level of MCC's Institutional Student Learning Outcomes, by noting in which courses outcomes are **Introduced (I), Developed (D)**, or where students are expected to demonstrate **Proficiency (P).**

Curriculum Map II:
    Departmental Opportunities for Student Progress toward ISLOs

	Course	**Course**	**Course**
Knowledge & Skills			
Critical Thinking			
Communication	**Introduced** MAT 060; 065;070;077	**Developed** MAT 075; 080;085;100	**Proficiency** MAT 120;130;131; 177;180;185; 190;250;280; 290;291
Personal & Professional Development			

d. *Please comment on the **sequencing of** opportunities for students to develop and achieve to ISLO proficiency within the department as appropriate, as noted on Curriculum Map II.*

See Question #7.

e. *Please indicate on the following pages as appropriate **how each ISLO is supported to proficiency achievement within the department and how that achievement is assessed. Where ISLO achievement is directly supported by DSLO achievement, you can refer the reader back to that section in Question 7, rather than re-writing it.** If the strategy for attainment of an ISLO is contained within a particular course, please list the course first, with the relevant activity (or activities) listed next to each course. If there is nothing currently in place that is intended to provide for the attainment of a particular outcome or to assess the extent to which the outcome has been realized, please leave the appropriate space blank. The blanks will help to identify areas which need further development.*

See Question #7.

Additional Curricular Opportunities:

9.   Please describe any interdisciplinary courses which are provided as an integral part of this department/area.

While there are no plans to market specific courses to new groups, the department is expanding the interest in mathematics by initiating a Math Across the Curriculum program. Through an NSF grant, several members of the Math department are working with Faculty from other disciplines to implement interdisciplinary modules that provide students with an immediate application of and connection between the Math that they learn in both disciplines. Faculty members in non-math courses are working with math faculty developing units where necessary math skills needed for a particular topic will be presented by or with the math instructor. Departments participating in these interdisciplinary projects include Science, Early Childhood Education, Psychology, English and Criminal Justice. Several courses have already implemented these units and projects and several more units are being developed with the support of the NSF grant. There is a Learning Community being developed integrating the Math and Science courses that are required for our Education students, along with an Education curriculum course.

The department has also developed a MOD (Math on Demand) Squad, where math faculty members are 'on call' to go into a class and present a math lesson as needed in another discipline. One full-time faculty member on each campus coordinates this and assists in connecting the requesting faculty with appropriate members of the department.

10.   Please comment on experiential learning opportunities with the department/area (i.e., internships, service learning). Discuss how the content of the experience relates to course credit. How do you calculate the number of contact hours required in relationship to the credit awarded? What percent of students participate in each of these activities?

Several members of the department have participated in the Lowell Civic Collaborative and continue to use these projects in their classes. This program has also been the subject of both local and national presentations at conferences by members of the math department. In general, the materials in our courses do not lend themselves easily to Service Learning and Internships.

11. Please comment on the uniformity and appropriateness of content in multi-section courses and subsequent courses now in place. Do all courses have the proper prerequisites? Is the flow and relationship of courses to one another satisfactory? Are there changes indicated, based upon department/area objectives and/or new needs identified through the assessment process?

The math department has a series of Course Coordinators who oversee the materials in multi-section courses. These faculty members prepare sample syllabi, course outlines and assignments for particular courses, especially those which are sequential and have many sections taught by adjunct faculty. Coordinators see that all faculty teaching a particular course have access to the above noted materials as well as, in some cases, a common final exam. Methods of communication with faculty teaching a particular course, using email and Blackboard are implemented by the coordinator. Topics covered by each course are generally determined by the department as a whole.

Changes both in content and prerequisites are considered and made as needed. Currently we are looking at the courses that are alternatives to Algebra 2, as the career programs using these courses have changed their required courses. An alternate prerequisite for Math Modeling is also under consideration.

The most recent major change is the increase of the prerequisite of all sequential courses to a C or better in the previous course.

12.   a.   Please comment on the role of developmental courses within your department/area. Which ones are relied upon by significant numbers of students in the department/area? What conclusions are you able to draw about the impact of these courses on students' preparation levels?

Developmental courses make up a large percentage of the department's curriculum, with a high percentage on incoming students testing into Fundamentals of Math, Algebra 1 and Algebra 2, as well as the courses that combine two of these. A new program giving students an opportunity to better prepare for the placement test is currently being piloted.

As noted in Section III, we have drawn conclusions from the data regarding the differences between students entering upper level courses from our developmental sequence and those who place directly into those courses. They are noted in detail there.

b.   Please comment on the role of developmental courses outside your department/area. Which courses in the department/area are relied upon by significant numbers of students, and which courses outside the department/area are relied upon by significant numbers of students? What conclusions are you able to draw about the impact of these courses on students' preparation levels?

The developmental Math courses provide students with the foundation needed to be successful in subsequent Math courses. Therefore they play an important role in the success of students in most programs.

In order to complete any degree at Middlesex, a student must successfully complete one course beyond Algebra I. Any transferable Math course has a prerequisite of at least Algebra II. Even many of the certificate programs require a minimum Math level of

Algebra I. Placement at the Algebra II level or below indicates a possible Math weakness that must be overcome before attempting higher level Math courses.

In the Fall 2009 semester, 70% (124 out of 178) of the Math sections offered are at the developmental level. Of these, approximately 42% (53 out of 124) are at the Algebra II level. Successful completion of these latter courses will allow students to complete degrees in Health Careers, Fire Science, Liberal Studies and Liberal Arts (non-transfer programs) as well as many Business programs.

13.   Describe the array of instructional methodologies in required or elective courses. (e.g. face to face, online, hybrid, self-paced, experiential, inquiry/problem-based, case studies, projects, etc.)

Face-to-face courses contain a combination of lecture, group work, technology projects and other in class innovations.
Online courses have been developed for the entire sequence from Fundamentals of Math through Precalculus 2, as well as Math Connections, Statistics and Introduction to Statistics.
Self-paced sections of courses from Fundamentals of Math through Intermediate Algebra are offered through the Center for Self-Paced Studies. A member of the SPS professional staff acts as a liaison to the department, attending and participating in all math department meetings.
A hybrid course that combines the materials in MAT 180 and MAT 190 into a single one-semester 4-credit course is being piloted in the Fall 2009 semester.

Many courses also contain projects for students to complete, some stressing computer or graphing calculator projects, while others require research and in the case of Statistics and Math Modeling, contain sufficient writing assignments to fulfill the Written Communication Intensive Value.

Section VI: Instructional Support

14.   **a.   Please discuss the adequacy of the staffing level in the department/area to teach students enrolled in the department/area.**

Though we have recently increased the number of full-time faculty, the bulk of the courses, especially on the developmental level, are taught by adjunct faculty. While we are proud of our adjunct faculty and feel that they make contributions to the department beyond the scope of their contractual duties (our last 4 full-time hires came from our adjunct faculty), it is still difficult to accomplish all of the department/division/college-wide goals to the best of our ability without faculty feeling overwhelmed and spread thin.

   b.   **Please discuss the adequacy of the staffing level in the department/area to advise students enrolled in the program.**

The math department faculty advises LAS and LS students, as we do not have any programs directly tied to the department.

15.   What specific support services and activities (i.e., tutoring, media, library, disabled student support, computer labs, and service learning) does this department/area require?   Please comment on the availability and adequacy of these services. Be specific about any current deficiencies or projected needs.

The Academic Resources Department provides math tutoring on both campuses. The staff of the Math Centers is greatly respected by the department (and again, includes members of our adjunct faculty), but as in all things, are limited by their funding. Faculty are working on a pilot of a required math center hour attached to the Fundamentals classes and one of the issues is the strain that will place on the resources of the Center.

The faculty works closely with the Disability Staff as needed.

16.   How adequate and appropriate are department/area facilities and equipment? Please be specific about any current deficiencies or projected needs.

The department has been able to obtain graphing calculator technology for classroom demonstrations through the efforts of the department chair taking advantage of programs provided by Texas Instruments, whose calculators are required in many of our upper level courses. However, as the technology continues to evolve, we cannot depend solely on this program for our technological needs.

Although there have been efforts by the college to update blackboards and computer access, faculty would also like to see more computer access/smart stations in classroom. Many ancillary materials are available online from our textbook publishers (e.g. PowerPoint presentations) and might be easily used in the classroom. In some classrooms that have only green or black boards, projections do not show up well. Faculty must sometimes choose between using the projector or using the blackboard, if a screen needs to be pulled down.

17.   Please describe any professional development needs of department faculty or staff.

Many department members have been able to attend the local NEMATYC conference each year through the division budget. As the fiscal crisis continues, there is concern that this may not be possible. The number of faculty who are able to attend our national conference (AMATYC) is limited by the Professional Development process. Next year (November, 2010) the national conference will be in Boston. The opportunity exists that many more faculty could participate, but there is concern that this will not be possible.

18. **Describe the sources of department/area funding. Are the funds adequate to support the department/area? Is the current use of funds effective to realize department/area goals? Does the department/area leadership have input into the department/area budget?**

The Math department does not have an independent funding source. All monies used are part of the Math/Science division budget. The budgetary needs of the department presently consist of:
- Institutional membership in AMATYC
- MathType upgrades
- Support to attend NEMATYC annual conference

The department does not require a large budget except for technology needs, and we have been fortunate in receiving free materials for the classroom due to the efforts of the department chair in following up on opportunities provided by Texas Instruments.

However, as the technology changes, we cannot rely solely on this program for our technology needs. The department has discussed obtaining and using other mathematical software, (such as Geometer's Sketchpad for the Elements of Math courses), which may require monetary support if adopted.

The greatest funding need is in full-time faculty positions as the increases we have seen since the last program review have not only stopped, but we have recently begun losing positions again, as retiring faculty are not being replaced.

The department is consulted about the budget and is able to have input.

Please provide any additional information that you consider important in assessing this department/area.

The department feels very strongly that the initiatives that they would like to pursue are being overshadowed by college wide demands. Last semester, we were asked to provide 12 faculty members for Title III committees, with 5 more expected to be needed this semester. This stretched the full-time faculty very thin, with several of us working on more than one committee in addition to the usual college service provided. It is felt that our department time needs to be more focused internally.

Section VII: Department Evaluation Summary

This section should be completed based upon review and consideration of both the data supplied in **Section II** and the questions posed in **Sections III, IV, V, VI and VII.**

A.   **Department Strengths**
      (Bulleted List with reference to the question(s) numbers in the department/area review where this strength is noted.)

▪ Strong, dedicated full-time and adjunct faculty
▪ Participation in both local and national professional organizations – often in leadership positions (6A)
▪ Continuous innovation in the classroom. (2B, 9, 10, 13)
▪ Student-centered teaching (1, 2B, 13)
▪ Supportive and caring learning environment (1, 2B, 13)
▪ Responsiveness to workforce needs; cooperatively develops appropriate courses as needed. (2B)
▪ Responsiveness to program needs of other departments; cooperatively develops and implements appropriate courses as needed. (4C, 4D, 9, 15)
▪ A variety of learning situations to match individual student learning styles. (1, 2B, 13)
▪ A full range of courses from developmental level through calculus. (Course flow chart in appendix.)
▪ Appropriate placement of students into a course appropriate to the student's ability and program needs. (12)
▪ Course coordinators and a strong community of support for our adjunct faculty. (11)
▪ An opportunity for interdisciplinary experiences. (9)

B. Department Needs for Improvement, Proposed Plans for Improvements, Budgetary Implications, Timelines

Department Needs (Reference the question in the program review where this need is explained.)	Proposed Plans for Improvement (Bulleted list of suggestions.)	Financial Needs to Make Improvements	Proposed Timelines for Implementation
Extra Time on Task (5a, 6a)	▪ Reinstate the pilot program to add an additional hour to the Fundamentals of Math courses. ▪ Consider the same concept for other developmental courses ▪ Look at current courses to determine that the time allowed is sufficient for students to learn the necessary skills and concepts.	Funding for additional staffing in the Math Center. Opportunity to increase credit hours for courses where that is found to be a need.	As funding allows.
Flexibility in Course Structure (5a,6a)	▪ In addition to the various offerings we currently have, give students the opportunity to move along the sequence more quickly by allowing short brief more focused 1 or 2 credit courses that will bring them up to a higher level more quickly.	Funding for instructors and Math Center staff.	As funding allows.
Utilize and Support a Professional Faculty (5a, 6a)	▪ Increase in the number of full-time faculty. Our department has been stretched quite thin by our involvement in many college-wide activities.	Funding to replace recent retirees.	As funding allows.
Develop courses as needed (11)	▪ Develop and implement an alternative course to Algebra 2 that will better suit the needs of our Liberal Arts/studies students		AY 2010-2011
Investigate suitable technology such as Geometer's sketchpad for the Elements of Math courses	▪ Incorporate this software into the Elements Math courses that are required for teachers.	Possible funding for the software for faculty	

APPENDIX

I. Data tables and charts regarding differences between students entering courses from the developmental sequence vs. those testing into the courses.

Table 1: Summary Data for MAT120, Math Modeling

Fall 2002 through Spring 2007, Fall and Spring semesters only	Students who placed into MAT120 via the Prerequisite Courses, Algebra I/II or Algebra II	Students who placed into MAT120 via score on Placement Exam (No need for remediation)
Category 1: Earned transfer credit Passed MAT120 with a grade of A, A-, B+, B, B-, C+ or C	577 (62%)	365 (64%)
Category 2: Passed but cannot transfer to another college Passed MAT120 with a grade of C-, D+, D or D-	138 (15%)	60 (11%)
Category 1 and 2 combined Passed MAT120 with a grade of D- or higher	715 (77%)	425 (75%)
Failed MAT120	104 (11%)	75 (13%)
Withdrew from MAT120	113 (12%)	71 (12%)
Total Enrolled	932 (100%)	571 (100%)
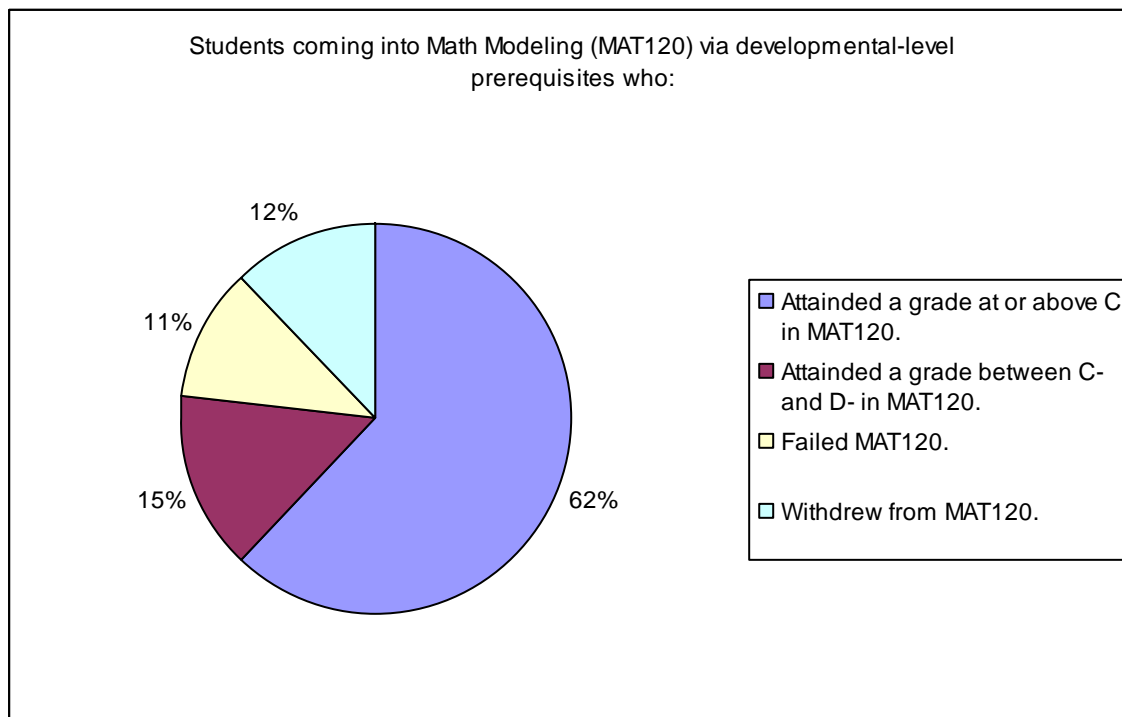
Chart 1: MAT120 Students with Developmental-Level Prerequisites

Students coming into Math Modeling (MAT120) via examination who:

- 64% — Attainded a grade at or above C in MAT120.
- 11% — Attainded a grade between C- and D- in MAT120.
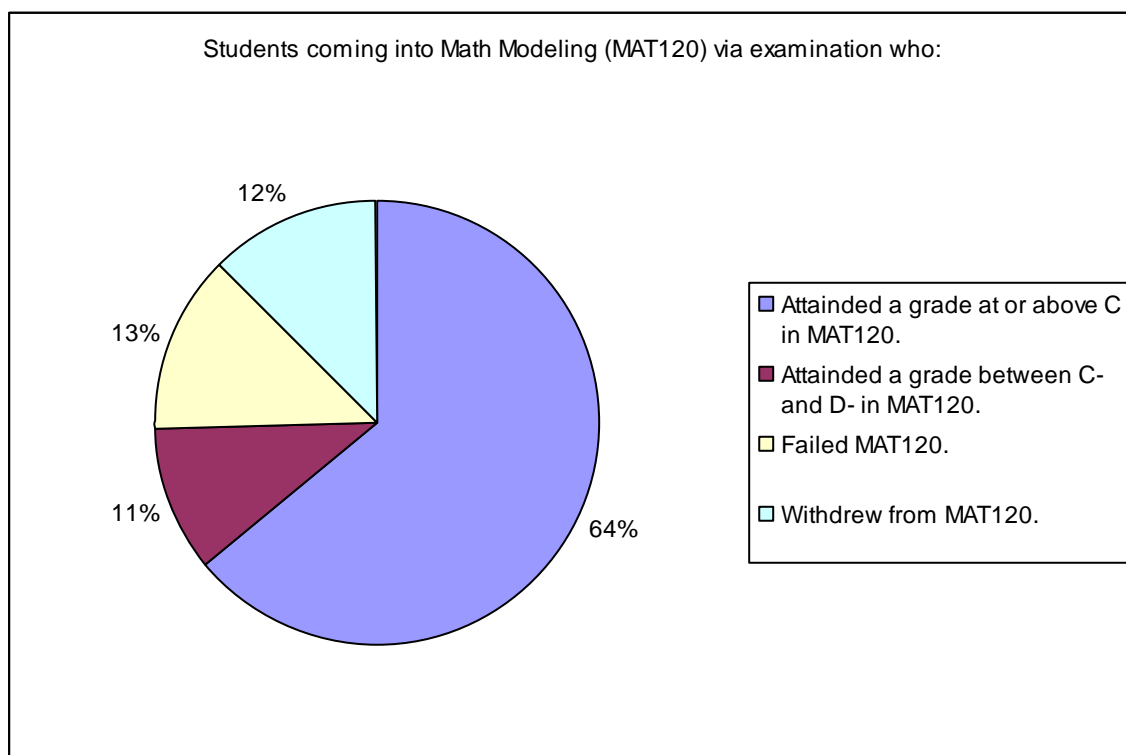- 13% — Failed MAT120.
- 12% — Withdrew from MAT120.

Chart 2: MAT120 Students without a need of Developmental-Level Prerequisites

Table 1: Summary Data for MAT180, Precalculus I for Business

Fall 2002 through Spring 2007, Fall and Spring semesters only	Students who placed into MAT180 via the Prerequisite Course, Intermediate Algebra	Students who placed into MAT180 via score on Placement Exam (No need for remediation)
Category 1: Earned transfer credit Passed MAT180 with a grade of A, A-, B+, B, B-, C+ or C	400 (52.6%)	221 (51.2%)
Category 2: Passed but likely cannot transfer credit to another college Passed MAT180 with a grade of C-, D+, D or D-	128 (16.8%)	54 (12.5%)
Category 1 and 2 combined Passed MAT180	528 (69.5%)	275 (63.7%)
Failed MAT180	92 (12.1%)	71 (16.4%)
Withdrew from MAT180	140 (18.4%)	86 (19.9%)
Total Enrolled	760	432

The data of Table 1 is illustrated in Charts 1 and 2 that follow.

Students coming into Precaculus I for Business (MAT180) via developmental-level prerequisite who:

Pie chart values:
- 53%
- 17%
- 12%
- 18%

Legend:
- Category 1: Pass with a grade at C or above.
- Category 2: Pass with a grade between C- and D-
- Failed
- Withdrew
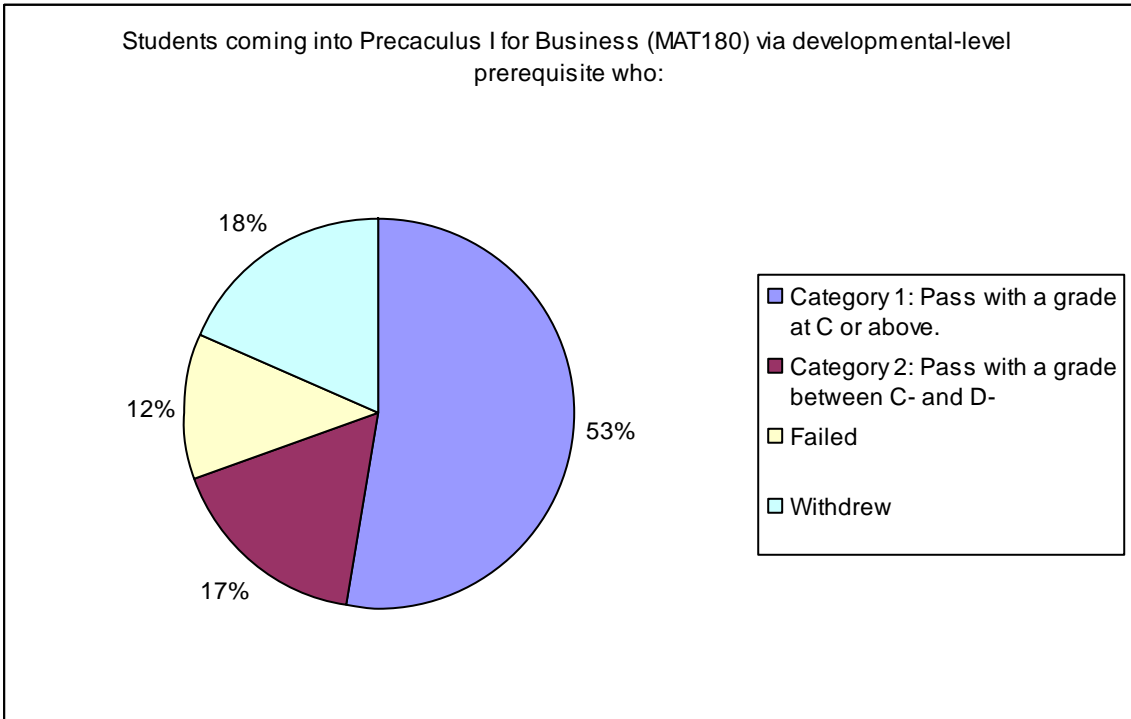
Chart 1: MAT180 Students **with** Developmental-Level Prerequisites

Students coming into Math Modeling (MAT180) via examination who:

Pie chart values:
- 51%
- 13%
- 16%
- 20%

Legend:
- Category 1: Pass with a grade at C or above.
- Category 2: Pass with a grade between C- and D-
- Failed
- Withdrew

Chart 2: MAT180 Students **without** a need of Developmental-Level Prerequisites

Table 1: Summary Data for MAT185, Precalculus I for Science

Fall 2002 through Spring 2007, Fall and Spring semesters only	Students who placed into MAT185 via the Prerequisite Course, Intermediate Algebra	Students who placed into MAT185 via score on Placement Exam (No need for remediation)
Category 1: Earned transfer credit Passed MAT185 with a grade of A, A-, B+, B, B-, C+ or C	192 (38.6%)	127 (46.0%)
Category 2: Passed but likely cannot transfer credit to another college Passed MAT185 with a grade of C-, D+, D or D-	92 (18.5%)	38 (13.8%)
Category 1 and 2 combined Passed MAT185	284 (57.1%)	165 (59.8%)
Failed MAT185	110 (22.1%)	54 (19.6%)
Withdrew from MAT185	103 (20.7%)	57 (20.7%)
Total Enrolled	497	276

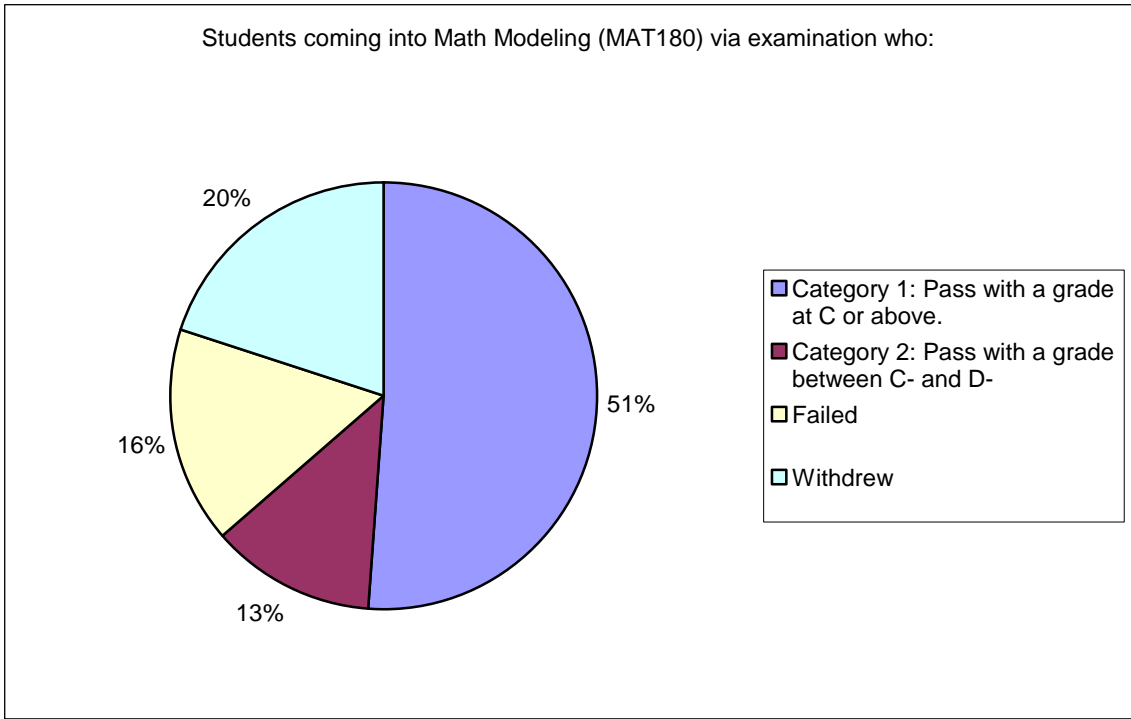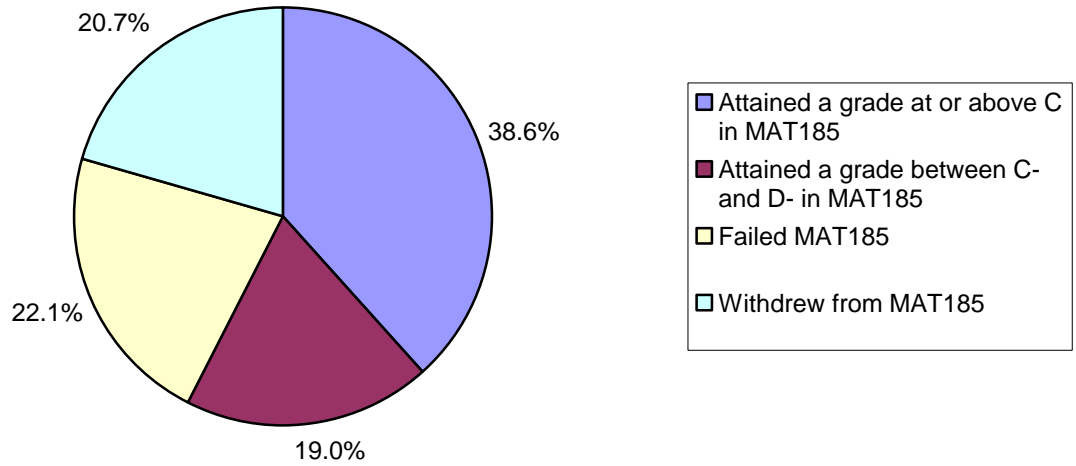The data of Table 1 is illustrated in Charts 1 and 2 that follow.

Students coming into Precalculus I for Science via developmental-level prerequisite who:

20.7%

38.6%

22.1%

19.0%

- Attained a grade at or above C in MAT185
- Attained a grade between C- and D- in MAT185
- Failed MAT185
- Withdrew from MAT185

Students coming into Precalculus I for Science (MAT185) via examination who:

21%

45%

20%

14%

- Attained a grade at or above C in MAT185
- Attained a grade between C- and D- in MAT185
- Failed MAT185
- Withdrew from MAT185
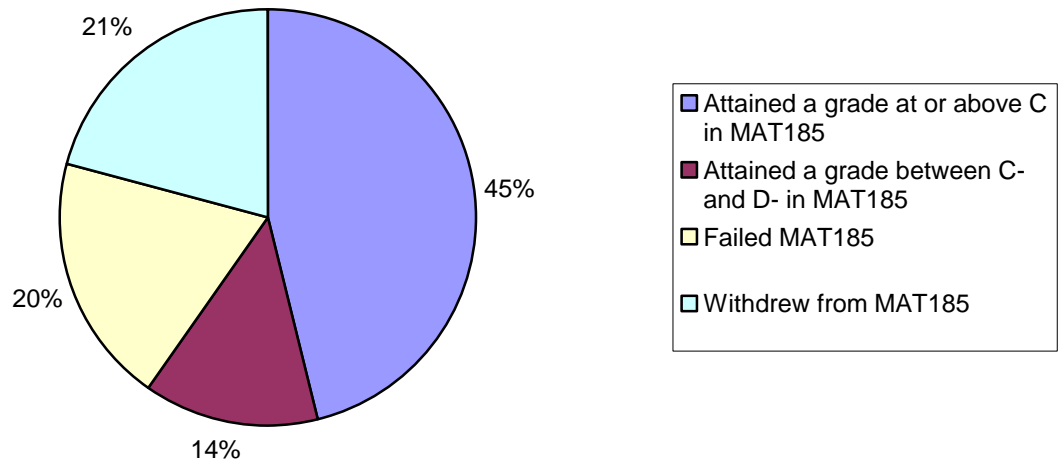
Retention rates:

Developmental Math Retention Rates Fall Semesters
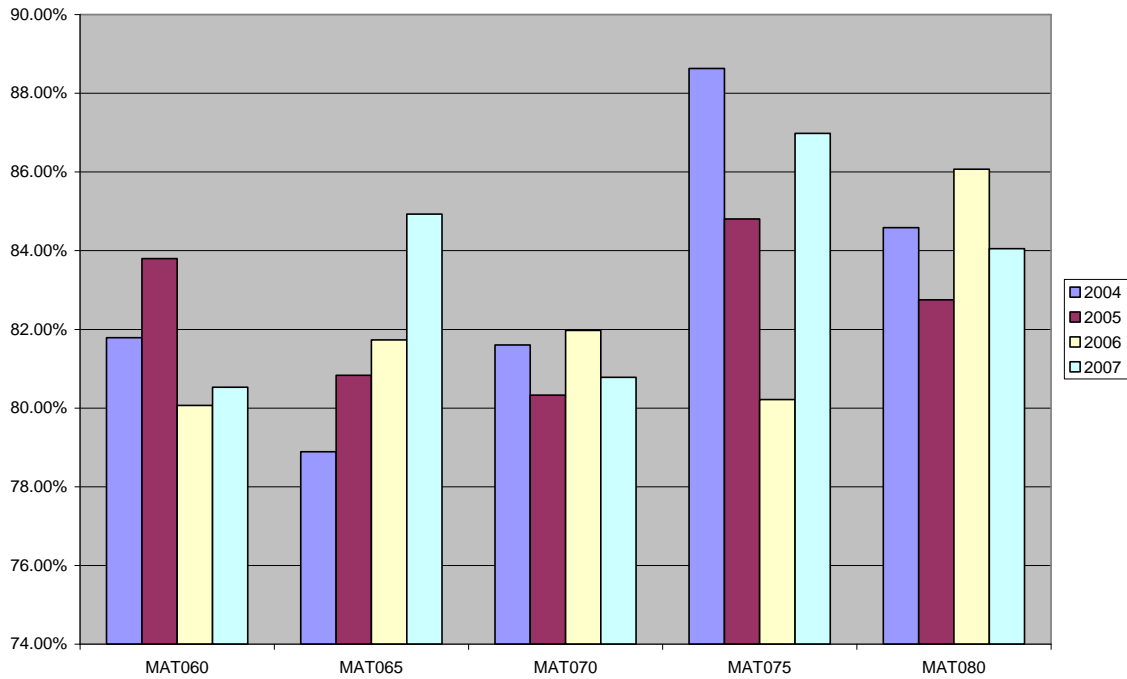
Non-developmental Math Retention Rates Fall Semesters

Program Courses Retention Rates Fall Semesters

Completion Rates:

Course Completion
Higher level Classes
Fall Semeters

Course Completion
Program Courses
Fall Semeters

34

Enrollment:

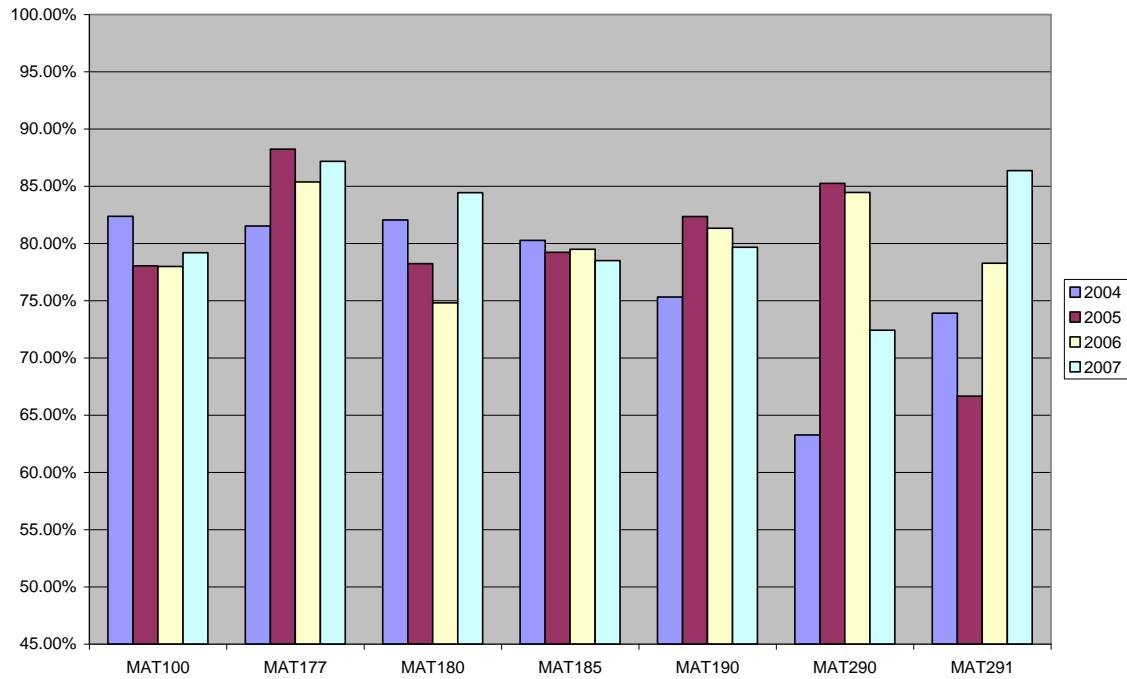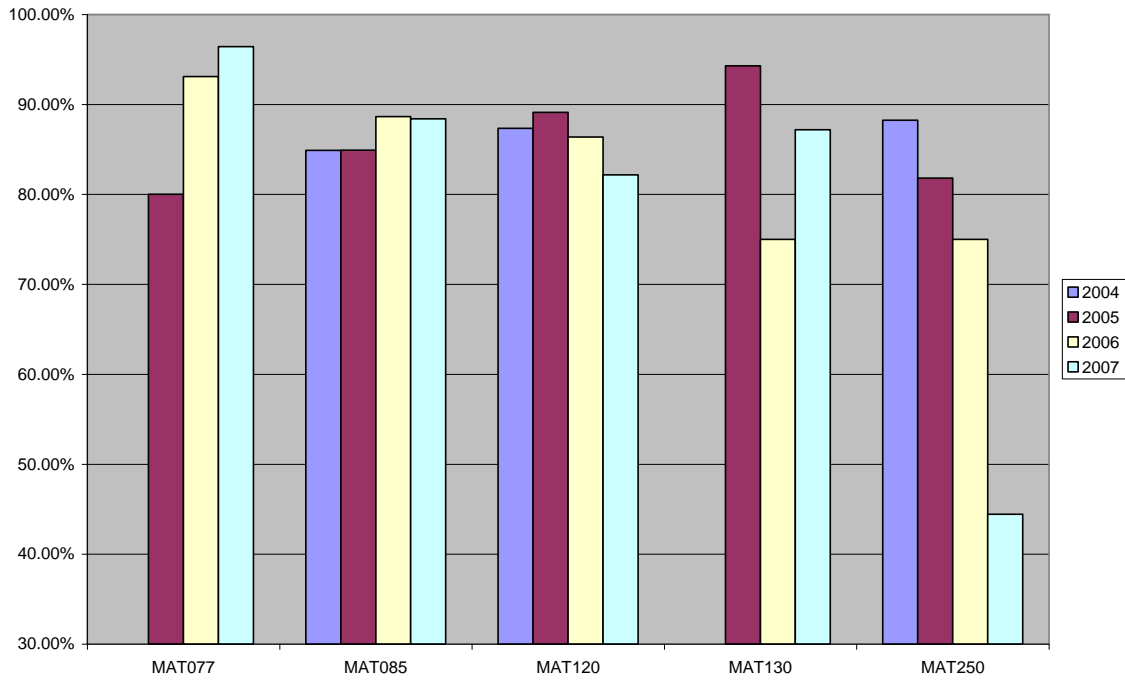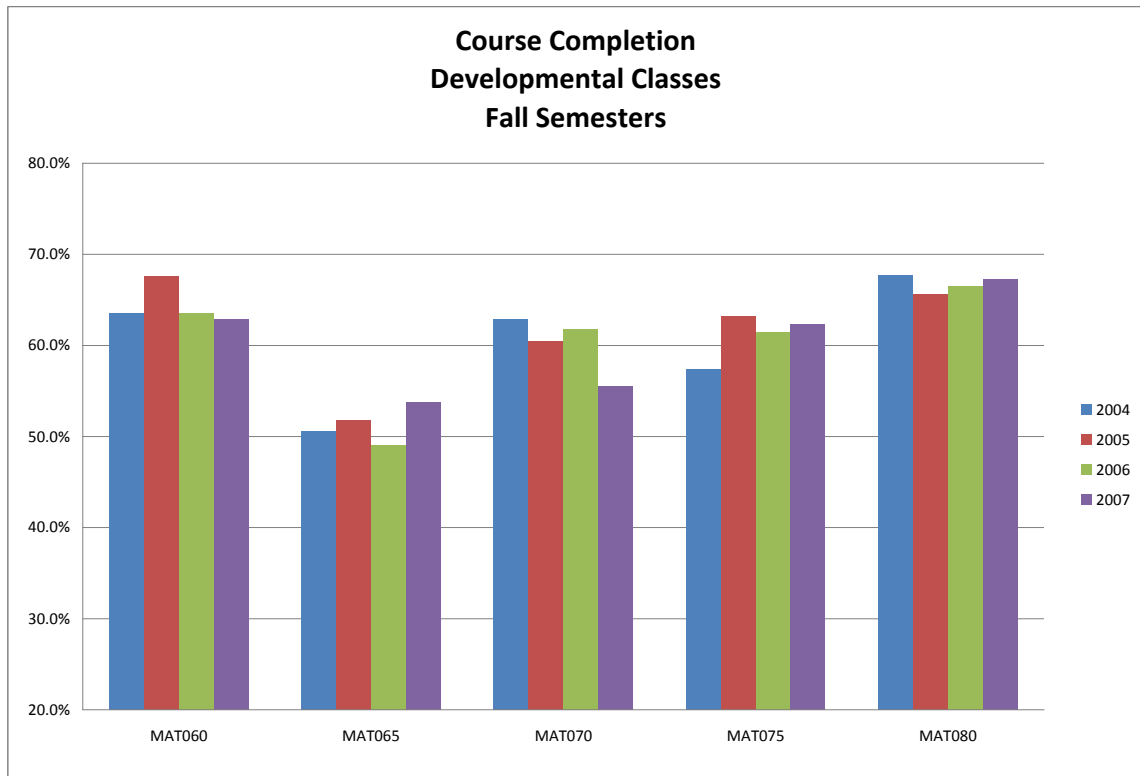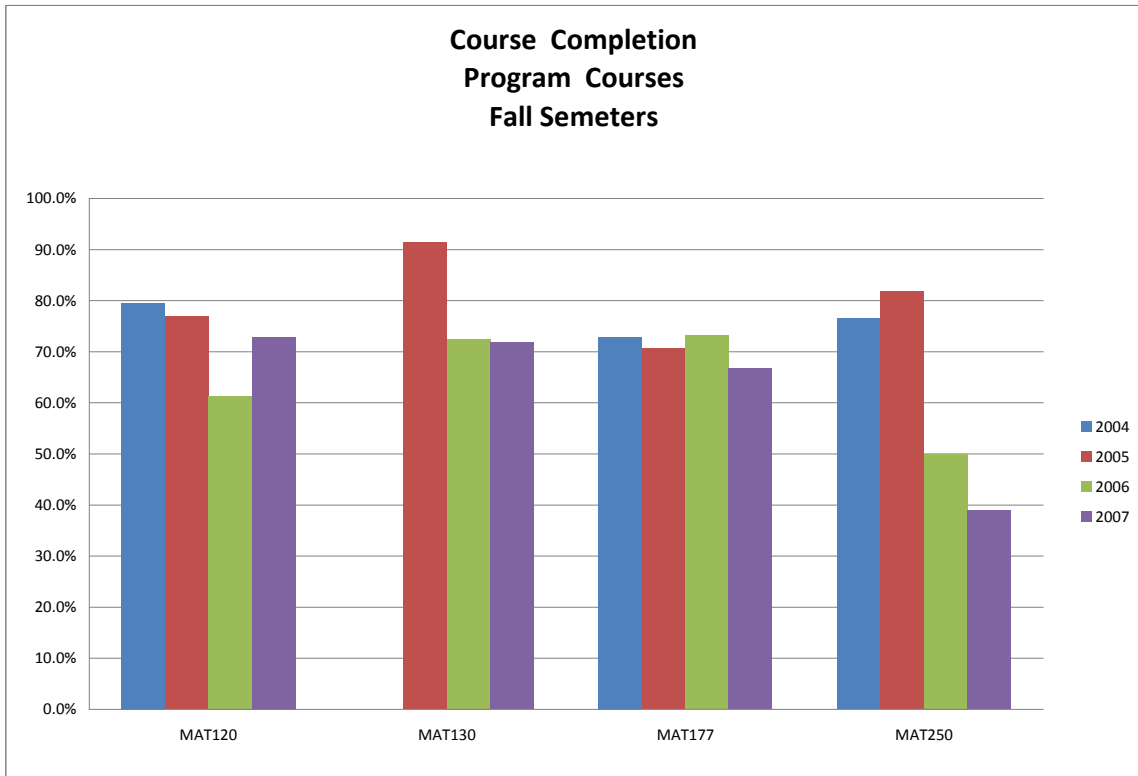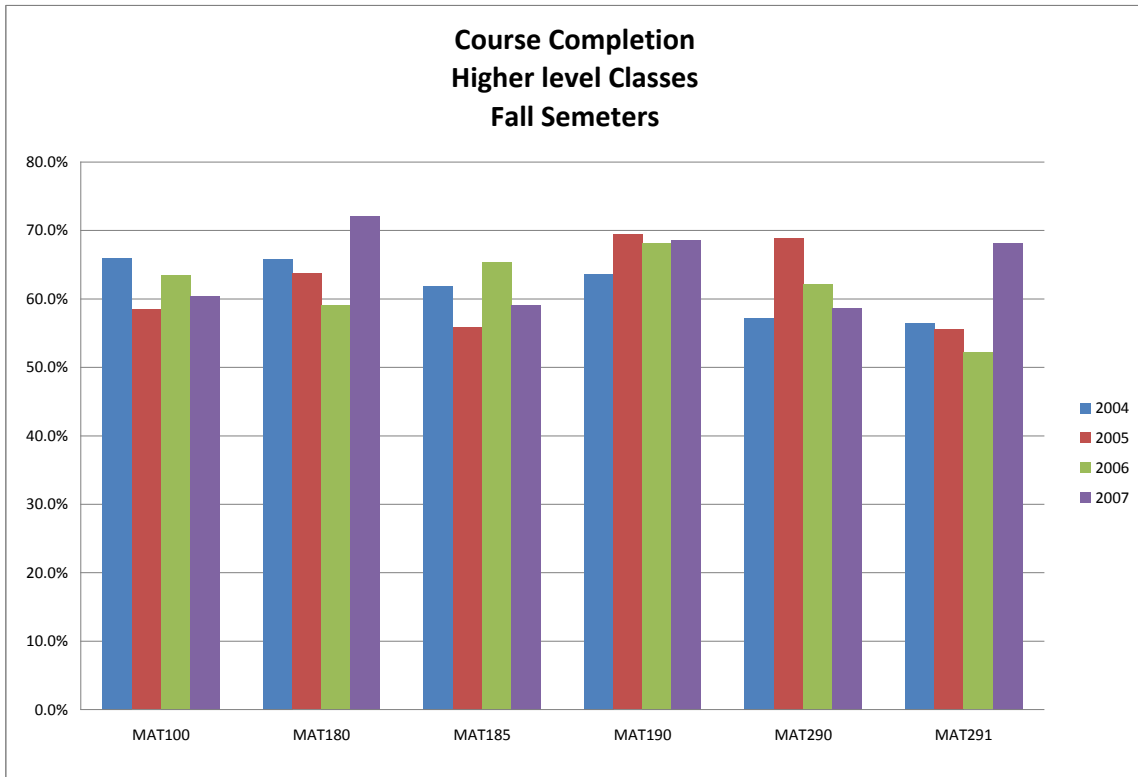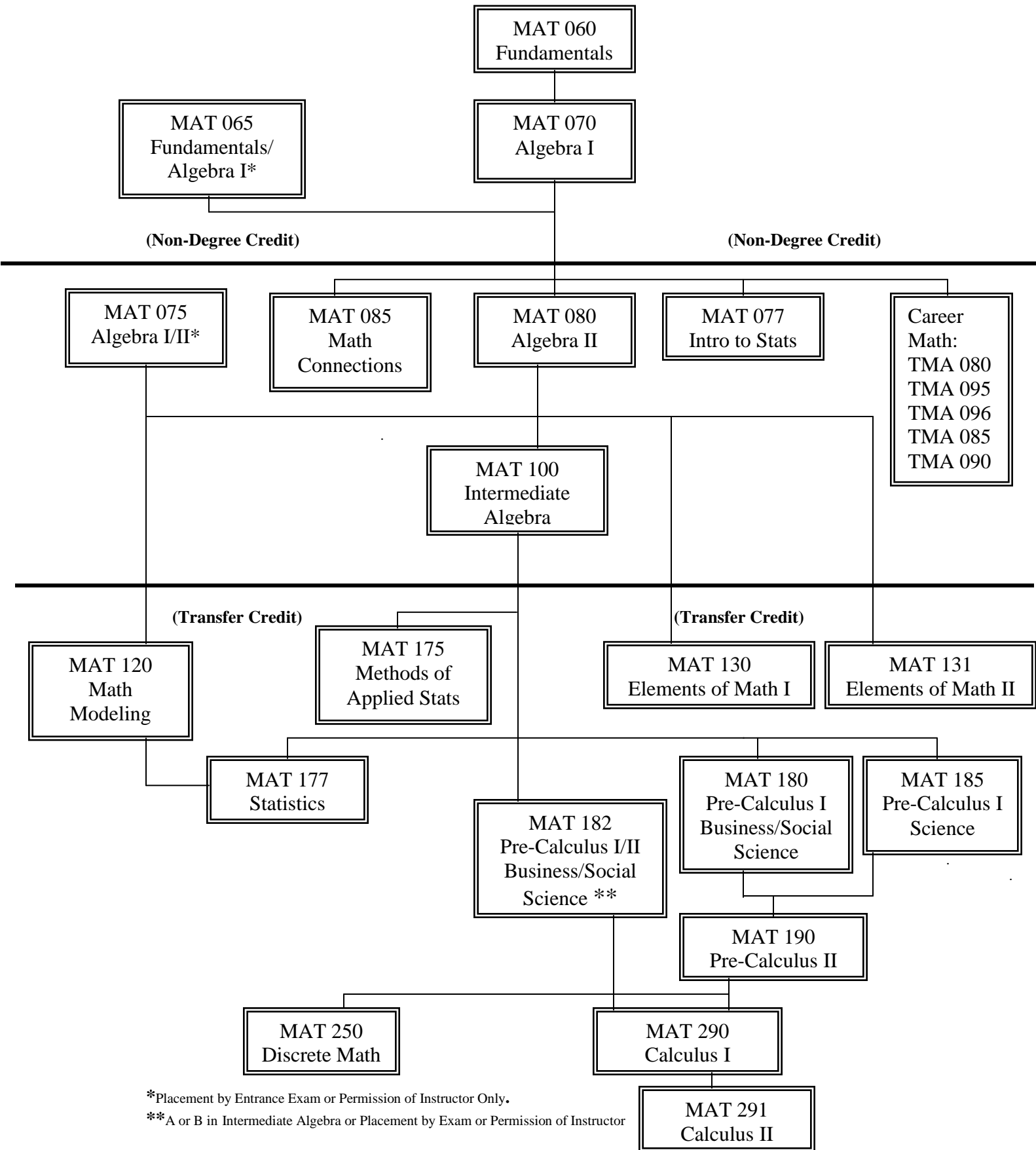| Total Math Enrollment	200409 3830	%	200509 3751	%	200609 3892	%	200709 3829	%
Fundamentals of Math	604	0.158	574	0.153	612	0.157	647	0.169
Fundamentals/Algebra I	180	0.047	193	0.052	208	0.053	199	0.052
Algebra I	674	0.176	610	0.163	660	0.17	666	0.174
Algebra I/II	211	0.055	204	0.054	187	0.048	215	0.056
Algebra II	882	0.23	852	0.227	890	0.229	865	0.226
Intermediate Algebra	329	0.086	378	0.101	386	0.099	394	0.103
		0.752		*0.75*		*0.756*		*0.78*
Precalculus I For Business	117	0.031	124	0.033	131	0.034	122	0.032
Precalculus I For Science	76	0.02	77	0.021	78	0.02	93	0.024
Precalculus I	44	0.012	36	0.01	31	0.008	0	0
Precalculus II	77	0.02	85	0.023	91	0.023	93	0.024
Calculus I for Science	49	0.013	61	0.016	45	0.012	58	0.015
Calculus II for Science	23	0.006	18	0.005	23	0.006	22	0.006
		0.102		*0.108*		*0.103*		*0.101*
Math Connections	172	0.045	126	0.034	141	0.036	138	0.036
Math Modeling	166	0.043	147	0.039	132	0.034	129	0.034
Intro to Statistics	0	0	0	0	29	0.007	28	0.007
Statistics	92	0.024	85	0.023	82	0.021	78	0.02
Elements of Mathematics I	0	0	35	0.009	40	0.01	39	0.01
Discrete Math	17	0.004	11	0.003	12	0.003	18	0.005
		0.116		*0.108*		*0.111*		*0.112*

Enrollment FALL 2004-2007

MATH COURSES

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                          ┌─────────────────┐
                          │    MAT 060      │
                          │  Fundamentals   │
                          └─────────────────┘
                                  │
┌─────────────────┐      ┌─────────────────┐
│    MAT 065      │      │    MAT 070      │
│  Fundamentals/  │      │   Algebra I     │
│   Algebra I*    │      └─────────────────┘
└─────────────────┘
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(Non-Degree Credit)   **(Non-Degree Credit)**

MAT 075 Algebra I/II*	MAT 085 Math Connections	MAT 080 Algebra II	MAT 077 Intro to Stats	Career Math: TMA 080 TMA 095 TMA 096 TMA 085 TMA 090

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                          ┌─────────────────┐
                          │    MAT 100      │
                          │  Intermediate   │
                          │    Algebra      │
                          └─────────────────┘
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(Transfer Credit)   **(Transfer Credit)**

MAT 120 Math Modeling	MAT 175 Methods of Applied Stats	MAT 130 Elements of Math I	MAT 131 Elements of Math II

MAT 177 Statistics	MAT 182 Pre-Calculus I/II Business/Social Science **	MAT 180 Pre-Calculus I Business/Social Science	MAT 185 Pre-Calculus I Science

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                          ┌─────────────────┐
                          │    MAT 190      │
                          │ Pre-Calculus II │
                          └─────────────────┘
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MAT 250 Discrete Math	MAT 290 Calculus I

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                          ┌─────────────────┐
                          │    MAT 291      │
                          │   Calculus II   │
                          └─────────────────┘
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*Placement by Entrance Exam or Permission of Instructor Only**.**

**A or B in Intermediate Algebra or Placement by Exam or Permission of Instructor

List of courses by number

MAT 060   Fundamentals of Math

MAT 065   Fundamentals of Math/Algebra I

MAT 070   Algebra I

MAT 075   Algebra I/II

MAT 077   Introduction to Statistics

MAT 080   Algebra II

MAT 085   Math Connections

MAT 100   Intermediate Algebra

MAT 120   Math Modeling for Liberal Arts

MAT 130   Elements of Mathematics I

MAT 131   Elements of Mathematics II

MAT 177   Statistics

MAT 180   Precalculus I for Business and Social Science

MAT 182   Precalculus I for Business and Social Science/Precalculus

MAT 185   Precalculus I for Science and Engineering

MAT 190   Precalculus II

MAT 290   Calculus I

MAT 291   Calculus II