Oklahoma City Community College

Program Review Self Study Year: 2016

Division of Mathematics, Engineering, and Physical Science

Associate in Science in Mathematics

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I. Introduction

This section should reference the general process of the review and any unique features of the review (such as the use of outside consultants or conducting the review in relation to an accreditation visit).

If the program has been reviewed previously, this section should include a brief summary of prior recommendations and how they were addressed.

The most prevalent concerns from the last two program reviews involved producing students who were better problem-solvers (as opposed to students good at memorizing and replicating procedures). Much of the revision to course resources, content delivery, and assessment was to address those concerns.

Another previous concern was the lack of support from transfer institutions and partner disciplines in developing advanced courses for program majors and students in partner discipline programs. That may be addressed in coming years by the state regents mathematics pathways initiative.

II. Executive Summary

The Executive Summary will include the program's connection to the institution's mission, program objectives, and the strengths and areas for improvement of the program. It will also include the key findings and recommendations of the internal or external reviews with regard to the Program Review Principles and Program Review Criteria.

The math program itself does not produce many majors. The program courses also serve the engineering program, and many of the students with math majors are also engineering or physics majors. So the assessment of the math program has been done for the past twelve years with a focus on how the major courses serve both the math majors and the partner disciplines of physics and engineering. Improving the focus on physical applications in the Calculus sequence also helps the pure math majors by providing them connections to partner disciplines they will need and find useful either as secondary mathematics teachers or as mathematicians working as analysts in business and industry.

To this end, the mathematics program will produce well-rounded students who are able to apply their mathematical knowledge in a world centered around data, technology and communication. Students will be able to make connections among geometric, symbolic, numerical and applied representations of mathematics.

The mathematics program's strengths are the willingness to respond to needs identified through program assessment, changes in available technology; discussions with partner discipline faculty; and the level of professional activity of its faculty (which in turn drives the first noted strength).

The major concerns about the program are its level of activity in general education assessment, especially artifacts from courses in the Calculus sequence; and the adapting or creating of courses in response to the anticipated statewide changes in developmental education expected to be introduced by Oklahoma State Regents for Higher Education. The department is working on initiatives to increase the number of artifacts submitted for general education assessment. Work on adapting courses for the new pathways will begin as soon as they are released to all institutions by the state regents. That will be more than just a math program undertaking, as information and opinions from partner disciplines and academic advisors will be included in any changes or course creation.

III. Analysis & Assessment

This section will include a complete review and analysis of the Program Review Criteria based on the internal or external team's review. It will also assess developments since the last program review in the context of the current recommendations of the internal review and any recommendations.

A. Centrality of the Program to the Institution's Mission

An assessment and written analysis as to the centrality of the program to the institution's mission and in the context of the institution's academic plan are required. The purpose of the mission of an institution is to indicate the direction in which the institution is going now and in the future. The mission defines the fundamental reason for the existence of the institution.

Together with the planning principles and goal statements, the mission reveals the philosophical stance of the institution with respect to education and learning while at the same time providing a framework for the maintenance of institutional integrity and development.

Describe how the program is central to the institution's mission:

Oklahoma City Community College Mission Statement

OCCC provides broad access to learning that empowers students to complete a certificate or degree and that enriches the lives of everyone in our community.

- Access: Our community has broad and equitable access to both highly valued certificate and degree programs and non-credit educational opportunities and events.
- College Readiness: Our students develop skills and knowledge required to succeed in college.
- Student Success: Our students successfully complete their academic courses, persist in college, and earn certificates or degrees at OCCC or another institution.
- Graduate Success: Our graduates go on to earn higher-level degrees or are successful in technical or professional careers.
- Community Development: Our community's quality of life is enriched through our educational, artistic and recreational programs and events.

The OCCC math program's course sequence of Pre-calculus, Trigonometry, and Calculus & Analytic Geometry I, II and III provide a strong foundation for students planning on transferring to four-year institutions to study mathematics in a pure or applied form or secondary education with an emphasis in mathematics or science. The courses also provide strong support for students in the computer sciences and engineering - springboard programs into existing disciplines and for the development and application of future technologies.

B. Vitality of the Program

Vitality of the program refers to the activities and arrangements for insuring its continuing effectiveness and efficiency. To maintain its vitality and relevance, a program must plan for the continuous evaluation of its goals, clientele served, educational experiences offered, educational methods employed, including the effective incorporation of technology, and the use of its resources. This vital principle or force can best be observed by examining the past and present initiatives to insure the vitality of the faculty, students, and program.

1. List Program Objectives and Goals

The mathematics program will produce well-rounded students who are able to apply their mathematical knowledge in a world centered around data, technology and communication. Students will be able to make connections among geometric, symbolic, numerical, and applied representations of mathematics.

2. Quality Indicators

Quality indicators may vary by institutional mission; however, institutions should measure the efforts and quality of their programs by: faculty quality, ability of students, achievements of graduates of the program, curriculum, library, access to information technology resources including efficiencies and improved learner outcomes through appropriate use of this technology and appropriate use of instructional technology to achieve educational objectives, special services provided to the students and/or community, and other critical services.

As appropriate, institutions should evaluate the program against industry or professional standards utilizing internal or external review processes. Institutions must provide specific documentation of student achievement. Such documentation should include programs outcomes assessment data consistent with the State Regents' *Assessment Policy*. Program quality may also be reflected by its regional or national reputation, faculty qualifications, and the documented achievements of the graduates of the programs. This includes a program self review that provides evidence of student learning and teaching effectiveness that demonstrates it is fulfilling its educational mission and how it relates to Higher Learning Commission Criteria and Components listed below:

a. The program's goals for student learning outcomes are clearly stated for each educational program and make effective assessment possible. List of the student learning outcomes.

Upon completion of the Calculus Sequence of the Mathematics Program (MATH 2104, MATH 2214 & MATH 2314), the learner

1) will demonstrate an understanding of the relationship between the graphs of functions and their derivatives

2) will demonstrate an understanding of the relationship between differential and integral calculus

3) will accurately represent physical phenomena or engineering models using derivatives, integrals, and differential equations

4) will apply calculus techniques to the solution of physics or engineering problems.

Well-defined the criteria for measurement and how the criteria were used in the program.

1) Seventy-five percent of the students assessed will sketch a correct representation of the derivative of a function given in graphical form, and these students will also be able to explain the concepts they are applying.

2) Seventy-five percent of students assessed will solve a problem involving Hamiltonian Systems and Exact Differential Equations. Eighty-five percent of the students will either completely and successfully answer the problem or will commit only a minor/careless computational or conceptual error.

3) Seventy-five percent of the students assessed will correctly model an application problem with a separable first-order differential equation.

4) Seventy-five percent of students assessed through test items will correctly model a chemical mixture problem with a linear differential equation and a moment/center of mass problem with integrals of a density function.

The evaluation, results, and recommendations based on the criteria used.

1) In the 2013 assessment of this objective, 72% of the students assessed provided a correct graph, and 67% correctly explained the concepts. In the 2015 assessment of this objective, 77% of the students assessed provided a correct graph, and 71% correctly explained the concepts. In the Fall 2014 semester, new course materials with more emphasis on geometric and conceptual aspects of Calculus were introduced.

2) In the 2012 assessment of this objective, 76% of the assessed students correctly solved the problem, and 88% either correctly solved it or committed only a minor/careless error. In the 2014 assessment of this objective, 74% of the assessed students correctly solved the problem, and 86% either correctly solved it or committed only a minor/careless error. The 74% would have been 76% again had one more assessed student correctly answered the question. The department concluded that there was consistency, but that there was still room for improvement in the form of more deliberate incorporation of and motivation by

engineering and physics examples early in the Calculus sequence.

3) In the 2013 assessment of this objective, 68% of the assessed students correctly modeled the problem. In the 2015 assessment of this objective, 85% of the assessed students correctly modeled the problem. The new resources introduced in MATH 2104 for Fall 2014 included more examples motivated by physics and engineering, introducing modeling concepts and ideas about differential equations earlier in the program.

4) In 2014 was the first assessment of this objective. 74% of the assessed students correctly modeled and solved the problems. There were no students who completed a successful model without also correctly solving the problems. Students who were incorrect used much simpler models than were required, resulting in much easier calculations and concept-application. This supported previous recommendations to be more deliberate about using physical applications and introducing conceptual aspects earlier in the Calculus sequence.

Overall, the switch to the more balanced approach to Calculus (computation, concept, geometry, application) has been beneficial for the students.

The General Education Core

General Education at Oklahoma City Community College is an integral component of each student's experience. Every student receiving an Associate Degree (AAS, AA, or AS) must complete at least one course from each of the following areas, indicating a general understanding of that area.

Human Heritage, Culture, and Institutions
Public Speaking
Writing
Mathematical Methods
Critical Thinking

Strategy:

The General Education Committee will create five interdisciplinary teams with members from multiple divisions. Each team will consist of five members with two members specifically teaching in one of the General Education Core Areas. Also, at least one team member will be a representative of the General Education Committee.

Twice a year these teams will evaluate one hundred artifacts from students having attained at least 35 hours of General Education Courses from OCCC. Reports, recommendations, and actions created from the General Education Assessment Process will be stored on the General Education Committee Website.

General Education Assessment Plan

Objective:

To assess and recommend actions for the general education component of Oklahoma City Community College's curriculum.

Method:

Developed rubrics will provide common criteria for assessing “artifacts” gathered from various courses. Artifacts may include but are not limited to recorded performances, PowerPoint Presentations, essays, lab reports, research projects, service-learning projects, or any assignment preexisting in a faculty's course.

Nevertheless, the underlying principle of this method is (1) to reduce the intrusive nature of assessment within faculty courses, (2) to create a real environment of student performances within a classroom setting instead of a contrived environment of a forced examination (i.e. CAAP exams not counting for a classroom grade), and (3) to collect artifacts already designed and administered by our professional faculty at OCCC.

Data Collection:

The Office of Institutional Effectiveness will identify each semester students completing at least 35 credit hours in General Education Courses.

Program Response to General Education Assessment Data

General Education requirements represent just over sixty percent of each Associate of Science or Associate of Arts degree, making the careful assessment of these broad competencies OCCC considers essential for all graduates very important. All programs (terminal or transfer) to be evaluated contain at least 18 general education hours within the curriculum. OCCC has six general education learning outcomes that we expect all of our students to be proficient in upon graduation, they are: human heritage, culture, values and beliefs; writing; public speaking; mathematical methods; social institutions; and critical thinking. Provide evidence that shows your participation in submission of artifacts, what types of artifacts are being submitted, and how you have used the general education assessment data to inform curricular refinement and to achieve these general education outcomes in your students in your program.

Program faculty serve as evaluators of the mathematical methods artifacts submitted and work with the general education committee to produce recommendations about general education mathematics and evaluation rubrics.

Mathematics faculty teaching program support courses have contributed artifacts for mathematical methods and writing. One faculty member had planned to submit artifacts for public speaking, but he left for a position at another institution before implementation in his courses. The mathematics faculty teaching required program courses (the Calculus sequence) have not submitted artifacts on a regular basis. The department's representative to the General Education Committee and one of the faculty who served as a math methods evaluator led a short workshop about developing, assessing and submitting artifacts from the program's required courses.

The mathematics faculty have, in the past, tended to think of their contribution to general education assessment as submitting artifacts in mathematics. While this is appropriate in some cases it is slowly being realized that general education mathematics artifacts should be coming from courses in programs that require college algebra, statistics or contemporary mathematics. The General Education Committee is helping with this effort. This includes adding a faculty member from the Business Division to the math artifact assessment team. In the meantime math faculty are

increasing their commitment to submitting artifacts of other kinds; particularly critical thinking and writing.

b. The program values and supports effective teaching.

Faculty Performance Review and Evaluation

Faculty will be evaluated on the basis of the established standards of performance and objectives established in the person's contract and any subsequent memorandums of agreement established for the position/person. Faculty are defined as employees who primarily perform teaching and instruction-related duties and who are employed on the basis of a written contract setting forth the duties to be performed and the compensation to be paid. The performance appraisal for each faculty member will be conducted by the Division Dean or Director as appropriate.

Course and Faculty Evaluation

The Student Input on Instruction process is a means of gathering student perceptions of instruction at the college. The results are intended to be used by you and your dean in identifying ways to improve instruction.

Students will receive an email during the 6th and 7th week for the first 8- week classes and the 14th and 15th week for the second 8-week courses and 16-week courses. The email will include the information to evaluate each course. The window for replying to these surveys will be closed at the end of the designated weeks. Faculty will not have access to their SII results until after grades have been turned in.

c. The program creates effective learning environment.

Program faculty regularly analyze success rates in all mathematics courses and discuss curricular changes and teaching methodologies that could improve student learning, comprehension and application. Many faculty members attend conferences and workshops in person and electronically to learn what other institutions have implemented successfully and unsuccessfully and to be exposed to new teaching and learning technologies.

Students are encouraged to use the Math Lab for homework completion and help and for group study. Some faculty members hold a few of their office hours in the Math Lab, making themselves more visible and accessible to students. The Math Lab is open over 70 hours per week and provides free tutoring for all classes offered by the Department of Mathematics. It is a place for students to study, work in groups, talk to tutors or just "hang out".

d.The program's learning resources support student learning and effective teaching.

As mentioned above, the Math Lab provides support for student learning and outside-the-classroom opportunities for faculty to engage small groups of students. Details about the Math Lab and its resources are given later in this report.

Also later in this report are details about the OCCC Library resources specific to mathematics and student learning of mathematics.

e. The institution's curricular evaluation involves alumni, employers, and other external constituents who understand the relationship among the course of study, the currency of the curriculum, and the utility of the knowledge and skills gained.

OCCC has established specific curriculum patterns for transfer programs leading to the Associate in Arts (A.A.) or Associate in Science (A.S.) degrees. Describe program coordination efforts, partnerships and relationships with transfer institutions.

The math department at OCCC participates in a regional effort with OKCPS and UCO to improve performance in mathematics courses, to increase participation in all STEM programs, and to improve a seamless transition between secondary and tertiary levels of education in the OKC metro area. The math department also participated in a statewide group working with the state regents and the UT Dana Center to create more efficient and transferable pathways to and through college math courses (and in turn to program courses in partner disciplines with math prerequisites).

Since there is not a state transfer category for calculus courses, the department has an agreement that the 12 hour calculus sequence is equivalent and transfers to other state institutions as equivalent to their calculus sequences. The courses are not guaranteed to transfer individually. The math department is always represented when the mathematics or statistics groups meet the annual Course Equivalency Project meetings at the University of Central Oklahoma. This is a

statewide meeting that establishes and maintains lists of courses that will transfer between institutions.

f. The organization learns from the constituencies it serves and analyzes its capacity to serve their needs and expectations.

The math program courses also serve the students in the physics and engineering programs. Many of the student learning outcomes reflect that our math majors need to be knowledgeable about the applications of mathematics and that our courses also help prepare students in other STEM disciplines for the mathematics and its applications in their program courses.

Math program faculty participate in state, regional and national organizations, and through these associations are able to informally gauge the success of program graduates as they move to four-year programs in mathematics, computer science, physics, engineering, geology, and meteorology.

3. Minimum Productivity Indicators

The following are considered to be the minimum standards for degree program productivity (averaged over five years). Programs not meeting these standards may be identified for early review as low producing programs. Institutions will be notified of programs not meeting either one of the two standards listed below and other quantifiable measures in this section.

a. Number of degrees conferred (averaged over five years, minimum standard: AA/AS/AAS 5)

The math department conferred an average 12.8 degrees per year over the past five years.

b. Number of majors enrolled (averaged over five years,minimum standard: AA/AS-25 AAS-17)

The math department had an average of 139 declared majors per year over the past five years. Most of these students declared mathematics as a second major because their primary program (engineering, physics, and computer science) required the same math and physics courses as the mathematics program.

4. Successful Course Completion

a. Report the successful completion rates of all major courses in the program.

Majors in mathematics are required to take the calculus sequence as "majors courses". These courses are MATH 2104, 2214, and 2314.

Course	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015
MATH-2104	70.0%	69.3%	70.2%	70.3%	72.6%
MATH-2214	60.9%	70.4%	74.7%	72.3%	76.6%
MATH-2413	91.0%	90.0%	84.5%	84.8%	83.6%

However, many of our majors begin at the trigonometry (MATH 1613) and pre-calculus (MATH 1533) level. Those courses also serve as general education courses for some students (see below).

b. Report the successful completion rates of all general education courses in the program.

The three courses traditionally associated with general education mathematics are College Algebra (MATH 1513), Contemporary Math (MATH 1503) and Introductory Statistics (MATH 2013), however, for more advanced students Pre-Calculus (MATH 1533), Trigonometry (MATH 1613), Business Calculus (MATH 1743), and Calculus and Analytic Geometry I (MATH 2104) will also fulfill the general education requirement.

Course	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015
MATH-1503	79.8%	79.9%	83.9%	83.3%	83.3%
MATH-1513	68.1%	69.1%	67.2%	70.4%	73.7%
MATH-1533	62.0%	64.8%	58.4%	55.3%	62.7%
MATH-2013	71.0%	75.3%	75.7%	77.4%	76.3%
MATH-1613	63.5%	61.0%	64.7%	64.2%	63.4%
MATH-1743	74.6%	76.3%	74.4%	78.1%	77.7%
MATH-2104	70.0%	69.3%	70.2%	70.3%	72.6%

c. Describe program student success initiatives.

In the Fall of 2010, the College Prep Math courses and revised Math Placement procedures replaced the developmental mathematics courses and Accuplacer.

The mathematics faculty have proposed a summer bridge program for students "almost" prepared for credit-bearing college math courses.

Compensated (funded through funds earmarked for achieving the dream initiatives) training occurred for all faculty teaching developmental mathematics courses in the Spring, Summer, and Fall of 2010. Since that time training has not been at the same level, however in April 2016 required training (or updated training) will be required for all developmental mathematics instructors. The training sessions will be turned into an online session for future developmental math instructors. The training this year is being funded by an internal Faculty Development grant.

College algebra content and pedagogy has been changed to reflect the way our developmental courses are now delivered.

Two faculty members will be updating the department's graphing calculator tutorials during the 2016. This work is funded by an internal Faculty Development grant.

d. Describe results from success initiatives and future plans to increase student success based on success initiative results.

Increased success rates in the College Prep Math sequence. Success rates in developmental mathematics have risen from approximately 47% to around 65%. This has increased the number of students taking general education mathematics and mathematics gateway courses to math, physics and engineering program courses.

The summer bridge program should allow more students to enroll in general education and STEM-gateway mathematics courses earlier in their college careers, ultimately producing more graduates (because research shows that longer times spent in college prep courses decreases degree-completion times and rates).

College algebra success rates have risen since the redesign and are now approaching 70%.

5. Other Quantitative Measures

a. The number of courses taught exclusively for the major program for each of the last five years and the size of classes for each program level listed below:

There are no courses taught exclusively for mathematics majors at OCCC. Math majors can be found in every math course offered (including developmental mathematics). The "majors courses" for math majors are the calculus sequence (MATH 2014, 2214, and 2314), however the majority of those enrolled in those courses are majoring in Engineering, Computer Science or Physics. The data below gives an indication of section numbers and number of enrollees by course level.

1000 Level Courses Exclusive for the Major Number of Courses Taught

Program	Degree	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015
Mathematics	AS	39	41	34	36	35

1000 Level Average Class Size

FY11	FY12	FY13	FY14	FY15
27.5	27.1	32.3	31.6	30.7

Total Enrolled

FY11	FY12	FY13	FY14	FY15
1,073	1,112	1,099	1,138	1,074

2000 Level Courses Exclusive for the Major Number of Courses Taught

Program	Degree	FY11	FY12	FY13	FY14	FY15
Mathematics	AS	40	44	45	47	48

* excludes specialized second level courses designed for individual instruction.

2000 Level Average Class Size

FY11	FY12	FY13	FY14	FY15
27.7	27.9	30.1	29.2	30.1

Total Enrolled

FY11	FY12	FY13	FY14	FY15
1,109	1,227	1,356	1,373	1,443

b. Student credit hours by level generated in all major courses that make up the degree program for five years.

There are no courses taught exclusively for mathematics majors at OCCC. Math majors can be found in every math course offered (including developmental mathematics. The "majors courses" for math majors are the calculus sequence (MATH 2014, 2214, and 2314), however the majority of those enrolled in those courses are majoring in Engineering, Computer Science or Physics. The data below gives an indication of credit hours by course level in mathematics.

1000 Level Courses within Program

Program	Degree	FY11	FY 12	FY13	FY 14	FY 15
Mathematics*	AS	11,553	12,270	13,122	13,083	13,203

2000 Level Courses within Program

Program	Degree	FY 11	FY 12	FY 13	FY 14	FY 15
Mathematics*	AS	5,639	6,231	6,782	6,845	7,321

c. Direct instructional cost for the program for the review period.

Oklahoma City Community College (OCCC) offers online courses (computer based/ Internet) which allow students the freedom from attending regularly scheduled course meeting times while still earning college credit. Online courses are similar to traditional, on campus courses in that they have a regular class schedule, assignment due dates, and the expectation of student interaction. OCCC has committed resources for the creation of specialized resources for online

students with the goal of increasing student success. These resources include a customized section of the OCCC website to assist them as they progress in their academic studies via distance and an orientation to the College's Learning Management System. We also provide virtual tutoring in the Math and Communication labs in addition to 24-7 tutor support through GradeResults to further customize and personalize online students' education. The cost of these initiatives and efforts totals $42,196. The cost of 24-7 technology support for student and faculty support those working within the learning management system is $70,500.00 (not including staff salaries 7:30-5:30 M-F).

Technology use in the classroom continues to expand to meet the needs of our students. 190 of our classrooms are equipped with permanent multimedia equipment with the availability of mobile carts to increase the number of high tech classrooms to 100%. The cost incurred with this multiyear effort was $1.55 Million. A faculty committee submitted a proposal for a classroom design that supports flexibility in classroom functionality including thin clients, a smaller folding presentation, and moveable furniture. This committee's proposal was adopted and supported by the Academic Affairs' Deans and President's Cabinet. Through a multi-department effort a total of $150,000 were spent to redesign three classrooms to support active learning and cooperative learning formats of instruction as well as a more traditional lecture style. Faculty members are continuing to utilize student response systems, SmartBoards, interactive projectors, tablets, and network computing devices in classrooms. OCCC continues to support the utilization of technology in the classroom so faculty can continue to engage students. The Center for Learning and Teaching offers multiple learning opportunities for faculty related to strategies for incorporating technology into instruction effectively as well as the use of the College's Learning Management System, Moodlerooms. The CLT team has strategically worked to meet the needs of our 163 full-time faculty as well as the 490 adjunct faculty members. They support them through organized workshops, online training modules, and individual faculty consultations conducted via phone, Skype, email, or in person. The consultations focus on instructional strategies, course design/redesign, assessment construction, selection and use of instructional technology, and aspects of using the College's LMS.

d. The number of credits and credit hours generated in the degree program that support the general education component and other major programs including certificates.

The data below is for four course (MATH: 1503 - Contemporary Math; 1513 - College Algebra for Business Life Science and Social Sciences; 1533 - Pre-Calculus; and 2013 - Introduction to Statistics. There are other courses that can also be used as general education courses (see above).

Gen Ed Courses - Number of Credits

Program	Degree	FY 2015
Mathematics	AS	12

Gen Ed Course Hours Generated

Program	Degree	FY 2015
Mathematics	AS	11,922

e. A roster of faculty members including the number of full-time equivalent faculty in the specialized courses within the curriculum.

The following list of faculty (full and part time) were the instructors in one or more 2000 level course in the last five years. These courses include the current calculus sequence, calculus II for business, life science and social science, introduction to ordinary differential equations, introduction to statistics, and mathematics courses intended for those majoring in early childhood and

elementary education. As such they represent a wide range of mathematical skills. Some of these courses are not directly associated with the mathematics major (see below).

Ali Alli
Betty Coleman
Brandon Tomson
Bruce Fiscus
Candace Andrews
Charles Oates
Christopher Oehrlein
Dale Duke
Daniel Bakewell
Daniel Benton
Ernest Gobert
Gail Malmstrom
Jamal Daneshfar
James Harrelson
Janet Mitchell
Jay Malmstrom
John Bridges
Linda Knox
Lisa Buckelew
Mahmoud Radfar
Marsha Austin
Nhanh Vo
Paul Buckelew
Rachel Bates
Radu Nicolescu
Rebecca Enns
Sherry Ray
Virgil Turner
Yumiko Akiba
Benny Phillips
Brenda Breeding
Charles Nunley
Courtney Miller
Frank Anderson

Program and FTE Totals Course FY 2015 (sections x credit hours)

	MATH-2013 57 - Statistics - Non-major
	MATH-2023 6 - Geometry and Measurement - Education
Mathematics	**MATH-2104 39 - Calc I - Math major**
AS	MATH-2123 18 - Business, Life Science and Social Science Calculus II
	MATH-2213 3 - Mathematical Systems - Education
FTE Total: 6.3	**MATH-2214 27 - Calc II - Math Major**
FTE MM: 3.5	**MATH-2314 24 - Calc III - Math Major**
	MATH-2413 15 - Ordinary Differential Equations - Math Majors

f. If available, information about employment or advanced studies of graduates of the program over the past five years.

Jobs as "mathematicians" are fairly rare, however students with AS degrees in Mathematics can go on to pursue many career choices. A selection is listed below:

Description	2014 Jobs	2024 Jobs	2014 - 2024	% Change

Statisticians	123	144	21	17%
Accountants/Auditors	8,997	11,031	2,034	23%
Mechanical Engineers	807	924	117	14%
Petroleum Engineers	1,245	1,596	351	28%
Civil Engineers	840	912	72	9%

g. If available, information about the success of students from this program who have transferred to another institution.

Students who transfer to OU, OSU, or UCO will have a grade point average equal to or better than the grade point average in that institution.

Transfer Student Performance

Type of Student	**2011 GPA**	**2012 GPA**	**2013 GPA**	**2014 GPA**	**2015 GPA**
UCO					
OCCC Transfer	2.9	2.9	2.8	2.9	2.9
All Undergraduates	2.8	2.8	3.0	2.9	2.9
OSU					
OCCC Transfer	3.0	3.0	3.1	3.0	3.1
All Undergraduates	3.0	3.0	3.1	3.0	3.0
OU					
OCCC Transfer	3.2	3.2	3.2	3.0	2.9
All Undergraduates	3.1	3.1	3.0	3.2	3.2

Source: UCO, OSU and OU OCCC transfer students at OSU had a higher GPA than their native students. OCCC transfer students had the same grade point average as the native students at UCO. OCCC transfer student GPA at OU was lower than all OU undergraduates.

6. Duplication and Demand

a. Demand from students, taking into account the profiles of applicants, enrollment, completion data, and occupational data.

There were not enough responses from math program graduates to get specific program data.

b. Demand for students produced by the program, taking into account employer demands, demands for skills of graduates, and job placement data.

There were no responses from employers of math program graduates. Many math program graduates transfer to four-year institutions in programs other than mathematics.

c. Demand for services or intellectual property of the program, including demands in the form of grants, contracts, or consulting.

Program faculty (including some adjuncts) have served as reviewers of new editions of textbooks or new features of technology support. One faculty member has served as a mentor and panelist for participants in the National Developmental Math Summit. One faculty member has served as an advisor for STEM initiatives in Boy Scouts of America. Faculty members have also served as the college's liaison to the local MathCounts, a middle school mathematics competition. Multiple faculty members serve as officers, board members, delegates and regular presenters and panelists for state, regional and national mathematics and mathematics education organizations.

d. Indirect demands in the form of faculty and student contributions to the cultural life and well-being of the community.

Many of the math majors work as tutors in the Math Lab where they help students in College Prep Math, general education math courses and other courses at OCCC (and some from other institutions) with significant mathematics components.

e. The process of program review should address meeting demands through alternative forms of delivery.

The support courses MATH 1533, MATH 1613 and MATH 2013 are all offered in online format. MATH 2013 and MATH 1503 are offered occasionally in hybrid (face-to-face/online blend) format. All program required and support courses are encouraged to incorporate some aspect of collaborative learning or project-based learning. Many program faculty incorporate guided preparation for class in paper worksheet/reading question form or as LMS quizzes over reading or video course material.

7. Effective Use of Resources

The resources used for a program determine, in part, the quality of the educational experiences offered and program outcomes. Resources include financial support (state funds, grants and contracts, private funds, student financial aid); library collections; facilities including laboratory and computer equipment; support services; appropriate use of technology in the instructional design and delivery processes; and the human resources of faculty and staff. The efficiency of resources may be measured by cost per student credit hour; faculty/student ratio; and other measures as appropriate. The effective use of resources should be a major concern in evaluating programs. The resources allocated to the program should reflect the program's priority consistent with the institution's mission statement and academic plan.

I. Library
Library collection evaluation - Mathematics

Fall 2015

Print and Online Resources

The OCCC Library's broad array of resources supports the Mathematics program and general education courses within that program--as well as heavy use by students fulfilling math general education requirements for other majors. The collection includes regular books, ebooks, DVDs, online streaming videos, and online article databases searchable by topic. Even with the recent redesign of the mathematics courses and enhanced Math Lab operation, students come to the Library for resources and assistance.

One of the most popular services is the Library's textbooks on Reserve program. Copies of most current textbooks are available for students to use in-house. Textbooks specific to mathematics courses used in the Fall 2015 semester are in heavy demand. They are listed below with numbers of checkouts as of midway in the semester:

APPM 1313/Math for Health Careers *Clinical Calculations* 378
Clinical Calculations, Suppl.1 6
APPM 1223/ Math for Tech Careers *Technical Mathematics* 0
MATH 0103/ College Prep Math I *College Prep Math I: Math 1003* 12
MATH 0203/ College Prep Math II *Prealgebra* 14
Prealgebra, Suppl.1 2
MATH 0303/ College Prep Math III *Beginning & Intermed Algebra* 40
MATH 1743/ Calculus I Bus/Life/Soc *Calculus Concepts* 1402
Calculus Concepts, Suppl.1 528
MATH1503/ Contemporary Math *for All Practical Purposes* 81
A Mathematician Reads the Newspaper 939
MATH 2213/ Mathematical Systems *Mathematics for Elementary Teachers* 4
MATH2413/ Intro to Ordinary Differential Equations *Differential Equations* 370
Differential Equations, Suppl. 1 328
MATH 1613/ Trigonometry *Trigonometry* 73
MATH 1533/ Precalculus/Analytic Geometry *Precalculus & Trigonometry* 87
MATH 1513/ College Algebra *College Algebra in Context* 320
MATH 2104/ Calculus & Analytic Geo I *Calculus: Single & Multivariable* 611
Student Solutions Manual 409
MATH 2123/ Calculus II Bus/Life/Soc - *Calculus Concepts* 1402
Calculus Concepts - Suppl.1 528
MATH 2013/ Introduction to Statistics *Essential Statistics* 388
MATH 2023/ Geometry & Measurement *Discovering Geometry* 5
BUS 1323/ Mathematics for Business Careers *Contemporary Mathematics for Business* 117
MATH 1513OL/ College Algebra Online *College Algebra* 31

The largest collection of materials supporting the Mathematics program can be found in the circulating collection. This section of materials needs and will get a thorough review, including weeding of crumbling and outdated items and purchase of appropriate new materials. Areas to be reviewed include these call numbers;

QA 1-70, 90-939 Mathematics, including mathematical logic, computer science, elementary math & arithmetic, algebra, probabilities, mathematical statistics, analysis, geometry, and analytic mechanics.

HF 5691-5696 Business math

Using article databases for focused research is important for non-major courses in the program, more than in math classes themselves. The Library provides excellent access to online article databases.

Other online resources for both students and faculty are *Films on Demand* with its nearly 20,000

documentaries and ImageQuest Database, a source of literally millions of images that can be used for student or faculty projects. The AV collection--mostly DVDs--continues to be well used, but increasingly online streaming videos are chosen by faculty and students where available. AV materials seem to be meeting student needs.

Instructional Resources

The value of good research collections, whether online or in print, depends also on whether or not students are aware of and have the skills to use them. Experience shows that typical students are not aware of resources available, but instead are "looking around on the Internet" with often very limited success.

To help alleviate this, librarians teach research skills. Students typically have not been taught to use article databases in math courses but sometimes acquire some research skills in other courses, most likely in the general education in the Success in College and Life course. Librarians staffing the Library Assistance desk answer informal student questions and provide one-on-one instruction. Another way to help students gain skills is found in the varied "how to find relevant and credible information sources" guides created by librarians and the many online tutorials available through the Library website.

In sum, Library resources supporting the Mathematics program are adequate but will be updated. Librarians are committed to providing the appropriate resources and helping students and faculty use them effectively. This may be more difficult in the new state budget crisis but the Library will work to keep collections updated and useful.

II. Math Lab

The Math Lab is located in the Science, Engineering and Math Center (2G4/5) just inside SEM 2 from parking Lot A and SEM 4 from parking Lots F and G. It provides free services intended to supplement mathematics learning for college students.

Calculators
A variety of Calculators is available for use in the Math Lab. Students enrolled in courses that require graphing calculators may lease a graphing calculator for a fee per semester.

Text Books/Manuals
A variety of textbooks, student solutions manuals, and calculator/software instruction manuals can be found in the Math Lab.

Tutors
Free tutoring is offered in the Math Lab, and no appointments are necessary. Math questions may also be answered by phone.

Computers and Internet Access
The Mathematics Computer Lab is located in the Math Lab. There are over 100 computers for student use. Students can work on their MyMathLab and ConnectMath homework. Computers in the Math Lab have complete access to the Internet. Faculty members regularly reserve one bay of computers for class time use to have students work on projects or complete computerized quizzes and tests.

Accommodations for Students with Disabilities
Text book and video screen magnifiers, talking calculators, height-adjustable desks are available for students with disabilities.

III. Classrooms
All classrooms used for mathematics courses are equipped with internet-connected computers, document cameras and projectors. Faculty members also incorporate the use of classroom clickers

for concept-quizzing and class data collection and computerized test-review games.

IV. Program Review Recommendations

This section is a description of recommendations that have been made as a result of the review and of actions that are planned to implement these recommendations. Recommendations should be clearly linked and supported by the information and analyses that were articulated in the previous sections and should contain a realistic strategy for implementation of any changes.

A. Describe the strengths of the program identified through this review.

The department serves its majors and students majoring in partner disciplines well. Program faculty respond to needs identified by program assessment and discussions with physics and engineering faculty to improve the courses and the content delivery.

The mathematics faculty is very active professionally at the local, state, regional and national levels.

Mathematics faculty and staff respond to needs as indicated by data. For example when success rates in college algebra declined after changes in our college mathematics preparation sequence faculty responded by making changes in college algebra's pedagogy. Success rates increased thereafter.

The mathematics program has a very strong developmental mathematics sequence. Success rates in the developmental sequence are high and success rates of students who place in college level classes after taking our developmental sequence are at the same level as success rates of those prepared for college level work at the beginning of their college career.

The mathematics department houses and maintains a one-of-kind lab/workspace for all students taking math courses. This 5000+ square foot facility offers free tutoring, study space and access to computers. It is open more than 70 hours per week.

B. Describe the concerns regarding the program that have been identified through this review.

Faculty morale has suffered in the last five years due to almost stagnate salaries that are compensated for by working ever increasing loads.

Ever increasing use of part-time faculty in developmental and college level courses. As of Fall 2016 56% of course sections were taught by adjunct faculty, and 65% of all sections were taught under "adjunct contract". The difference in these numbers indicates that full time mathematics faculty teach many courses beyond their minimum load. While we acknowledge that our part-time faculty are high quality and add diversity to the faculty they are not, in general, professional teachers. They are also available primarily in the evenings. Our demand however is for morning and daytime classes. This has resulted in a lack of full time instruction in the evenings and at night and in the employment of "day time" adjuncts who might not be employed with us were in not for their scheduling availability.

Program faculty need to submit more artifacts for general education assessment, especially from the courses in the Calculus sequence.

The anticipated pathways that are being developed by a state regents working group will provide a challenge for the department. The program courses will not be affected, but some of the support courses will be adapted or replaced for other pathways. Determining proper prerequisites and course substitutions for students will create a lot of work for the department and subsequently academic and faculty advisors throughout the institution.

C. Develop a list of recommendations for action that addresses each of the identified concerns and identify planned actions to implement recommendations.

Hire new full-time mathematics faculty at the earliest possible opportunity.

As soon as funding is available increase pay levels for both full and part time faculty.

The mathematics faculty has begun to identify possible test or project items that could be submitted from calculus courses for general education assessment in math methods and possibly for writing and public speaking. Expanding this initiative to include adjunct faculty will be the next challenge.

The department will have to wait for the actual revealing of the new state mathematics pathways to decide how to work with partner disciplines to adapt or create courses to fit the transfer requirements for those pathways. There may be opportunities to develop courses that in the past have been desired but not developed because of a perceived lack of interest or need. These courses could include Discrete Mathematics, Finite Mathematics or Statistics II.

D. Provide institutional recommendations as the result of the program review and planned actions to implement recommendations.

1) Lack of Full-Time Faculty

Full time faculty are the backbone of any program, but none more so than in the case of the mathematics program/department. Mathematics teaching methodology is constantly changing and mathematics courses are often identified as obstructions on the road to successful completion of college credentials. Our part time faculty are wonderful. However they do not have the time, resources or in many cases the motivation to continually innovate and respond to outside forces. Additionally, and importantly, part time faculty are not generally available during the day, which is where our enrollment growth opportunities exist. Adequate full time staffing would allow for a better experience for all students and allow for enrollment growth.

Currently OCCC (and all of higher education in Oklahoma) is dealing with a budget crisis that makes it difficult to replace faculty who retire or resign, much less add to staffing. However the Institution realizes the need to maintain appropriate staffing and is committed to doing so as the budget permits. The dean of mathematics, engineering and physical sciences will continue to present increased staffing as a strategic initiative during budget planning.

2) Increased Pay

College administration and the Board of Regents are very aware of the quality of our faculty and staff and are committed to increasing compensation as funds become available.

3) General Education Artifacts

The administration and the General Education Committee will continue to educate faculty on the kinds of artifacts needed; encourage participation; and assist faculty in the development and submission of appropriate artifacts. Beginning in the summer of 2016 a faculty member from the division of business will serve on the mathematics assessment team. Hopefully this will lead to more mathematics artifacts from outside of MEPS. Additionally it is hoped that the inclusion of this new member will lead to discussions inside the mathematics department about what constitutes a good artifact, which in turn will lead to more submissions.

4) Pathways and the Corequisite Model

The OSRE are expected to make recommendations (or issue mandates) regarding the structure and instructional methodologies of developmental and "first level" college mathematics courses in the Fall of 2016. OCCC faculty and administration are actively involved in this project. Since most of our students plan to transfer to a University program it is highly unlikely that we will seek an exception from the Regents. We will attempt to comply with any OSRHE suggested (or mandated) change while retaining as many of the methods and instructional philosophies as possible from our current, very successful, developmental program. We will also look for opportunities to expand our college level offerings where appropriate. These changes may occur as soon as the fall semester of 2017.

As the state working group develops and implements a new set of transferable pathways to and through mathematics courses, other academic divisions will need to decide which pathways fit their students, and advisors will have to familiarize themselves not only with the pathways OCCC offers, but also how they transfer to and from other institutions. These pathways will be targeted to students with specific major or program needs and many not substitute for each other.

Appendix

Program Curriculum

Program Requirements

Minimum Required Hours 61

Major Courses		
Prefix & Number	Course Title	Credit Hours
MATH 2214	Calculus and Analytic Geometry II (C)	4
MATH 2314	Calculus and Analytic Geometry III (C)	4
	(C) A grade of "C" or higher must be achieved.	

General Education Courses		
Prefix & Number	Course Title	Credit Hours
ENGL 1113	English Composition I	3
ENGL 1213	English Composition II	3
HIST 1483	U.S. History to the Civil War --OR	
HIST 1493	U.S. History Since to the Civil War	3
*MATH 2104	Calculus and Analytic Geometry I	4
POLSC 1113	American Federal Government	3
BIO 1114	General Biology (non-majors) --OR Biological Science 2000 Level	3-4
PHYS 2014	Engineering Physics	4
HUM	Humanities Elective (PHIL 1603 recommended)	3
	General Education Electives	12

Support Courses		
Prefix & Number	Course Title	Credit Hours
	Guided Support Elective:	11
	Selected from the following approved support courses with at	
	least one course at the 2000 level:	
	MATH 1503; MATH 1533; MATH 1613; MATH 2000;	
	MATH 2013; MATH 2023; MATH 2213; MATH 2413;	
	CS 1143; CS 2123; CS 2163; CS 2363; any 2000 level BIO;	
	CHEM 1115; CHEM 1215; any 2000 CHEM; ECON 2113;	
	ECON 2123; and any ENGR; GEOL 1114; PHYS 1504--OR	
	PHYS 1514 (but not both); any 2000 level PHYS.	

Life Skills Courses		
Prefix & Number	Course Title	Credit Hours
SCL 1001	Success in College and Life	1