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- AB 705 Discussion

Department Meetings

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- Math Department Meeting January 15, 2016
- Department Meeting Agenda August 21, 2015
- Department Meeting Agenda August 22, 2014
- Math Meeting Minutes 2011

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Mathematics AS-T Program

Mathematics Associate in Science Degree for Transfer

Program Review

Cerro Coso Community College

Steve Rogers

April 26, 2016

Executive Summary

The Associate Degree for transfer provides students with a clear pathway to transfer into the CSU system and pursue a baccalaureate degree in applied or pure mathematics, mathematics education, statistics, engineering, natural or physical sciences, and economics. The courses for the degree are offered consistently at the Ridgecrest campus as well as online in order to meet the needs of working students and provide access to students located throughout the service area.

The Math Degree is available to students throughout the Cerro Coso service area. This includes the Ridgecrest Main campus at Indian Wells Valley (IWV), Kern River Valley campus (KRV), the Eastern Sierra campuses (ESCC) at Mammoth Lakes and Bishop, as well as students in the Tehachapi, California City and Mojave areas. In the past, excluding dual enrollment at Tehachapi High School and with the exception of the Statistics and Honors Statistics courses, the math courses as well as some of the prerequisite math courses for the program were only offered in the on-ground delivery mode at the IWV campus. However, beginning in fall of 2016, PreCalculus will be offered on-ground to students at KRV followed by Trigonometry in spring of 2017. However, all students throughout the entire service area have access to the degree by means of online course offerings.

There are several actions which the department would like to implement to improve the AS-T Math Degree Program. First of all, the department plans to design an online curriculum for the Differential Equations course in the program to address the needs of the students pursuing the degree online. Second, the department seeks to attract more students into the program and track the progress of those students in order to increase the number of completers of the degree. Third, the department seeks to draw more math majors from KRV, ESCC and the Tehachapi area by putting prerequisite courses to the math program in the curriculum at those sites. Finally, being that this was the first time this program has been reviewed and the outcomes in the courses formally assessed, it is apparent that the student learning outcome assessment process needs to be improved. For the next assessment cycle the department will increase assessment consistency, the promptness and effective reporting out of results, and documentation of strategies to be implemented for reassessing those outcomes that miss the minimum success target rate.

Part 1—Relevance

1. Catalog Description

ASSOCIATE IN SCIENCE DEGREE IN MATHEMATICS FOR TRANSFER: This course of study prepares students for transfer to the CSU System to earn a baccalaureate in applied or theoretical mathematics, mathematics education, statistics, engineering, natural or physical science, or economics. Upon

successful completion of the program students will be able to apply advanced mathematical concepts such as extending the concepts of derivatives, differentials, and integrals to include multiple independent variables, solving simple differential equations of the first and second order, and analyzing and modeling the behaviors of physical phenomena using calculus. Baccalaureate options for students include General Mathematics, Applied Mathematics, Mathematics Education, Statistics, Physics, Chemistry, Biology, Computer Science, Engineering, Computer Information Systems, Management Information Systems, and Economics. To complete the degree, students must fulfill both of the following requirements:

(1) Completion of 60 semester units that are eligible for transfer to the California State University, including both of the following:

(A) The Intersegmental General Education Transfer Curriculum (IGETC) or the California State University General Education-Breadth Requirements.

(B) A minimum of 18 semester units in a major or area of emphasis, as determined by the Kern Community College District Board of Trustees.

(2) Obtainment of a minimum grade point average of 2.0

Please note that our local Cerro Coso general education pattern **may not** be used to fulfill the requirements of this degree and that all required courses for the degree must be transferable to CSU.

The program description adequately describes the mathmatical rigor of the program without being overly specific about all of the mathematical skills students will possess upon completion of the program. It also aptly describes the diverse tranfer options.

2. Program Learning Outcomes

Upon successful completion of this program, 80% of the students should be able to

1. use the Cartesian, polar, cylindrical, and spherical coordinate systems effectively.
2. use scalar and vector products in applications.
3. use vector-valued functions to describe motion in space.
4. extend the concepts of derivatives, differentials, and integrals to include multiple independent variables.
5. solve simple differential equations of the first and second order.
6. analyze and model the behaviors of physical phenomena by applying advanced calculus concepts.
7. apply broad mathematical concepts to practical applications.

While students exiting the program would possess a broad range of specific math skills, the PLO's listed above sufficiently capture the key knowledge and skills the students will have upon completion of the program. The last two PLO's, which require students to model physical phenomena and apply math skills to applications, illustrate that students will be prepared to apply the math skills they have learned directly in their chosen careers or fields of study. Since the degree consists of courses built on a framework of SLO's, which are measured by exam and which align with the PLO's, the PLO's themselves are measurable, realistic and acheivable.

3. Courses/Program Matrix

MATH C151	Analytic Geometry and Calculus I	5 units
MATH C152	Analytic Geometry and Calculus II	5 units
MATH C251	Analytic Geometry and Calculus III	5 units

Choose a minimum of 7 units from below with at least 4 units from Area A:

Area A		
MATH C255	Ordinary Differential Equations	4 units
MATH C257	Linear Algebra	4 units

Area B		
MATH C121	Elementary Probability and Statistics	4 units or
MATH C121H	Elementary Probability and Statistics – Honors	5 units
PHYS C111	Mechanics	5 units
CSCI C251	Intro to Programming Concepts & Methodologies	3 units
CSCI C252	Intro to Computer Science	3 units
CSCI C265	Introductory C++ Programming	3 units

Program Matrix

Courses	**Program Learning Outcomes**						
	1	**2**	**3**	**4**	**5**	**6**	**7**
CSCI C251							X
CSCI 252							X
CSCI 265							X
MATH C121							X
MATH C121H							X

MATH C151	X	X	X	X	X		X
MATH C152	X	X	X	X	X		X
MATH C251	X	X	X	X	X		X
MATH C255						X	
MATH C257						X	
PHYS C111		X	X			X	X

The AS-T Degree in Mathematics consists of 60 units total, 22 of which are in the major. As can be seen from the above program matrix, the math course offerings provide a clear path to achieving the program learning outcomes. Two full-time math faculty recently reviewed all of the SLO's in the program and aligned them with the PLO's. The PHYS C111 class contained one SLO aligning with PLO 2, two SLO's aligning with PLO 3, three SLO's aligning with PLO 6 and two SLO's aligning with PLO 7. The SLO's for all of the required computer science courses could only be put under PLO 7 (problem solving) as the other PLO's seemed overly math specific to align with computer science content.

4. Program Pathway

FALL SEMESTER 13-14 units	ENGL C101 (4 units)	General Education Requirement (3 units)	General Education Requirement (3 units)	General Education Requirement (3 units)	Physical Education Course (1 unit) *only required if following CSU GE Cert
SPRING SEMESTER 14-15 units	MATH C151 (5 units)	General Education Requirement (3 units)	General Education Requirement (3 units)	General Education Requirement (3 units)	Physical Education Course (1 unit) *only required if following CSU GE Cert
FALL SEMESTER 17-19 units	MATH C152 (5 units)	Major Elective (3-5 units)	General Education Requirement (3 units)	General Education Requirement (3 units)	General Education Requirement (3 units)
SPRING SEMESTER 17-20 units	MATH C251 (5 units)	Major Elective (3-5 units)	General Education Requirement (3 units)	General Education Requirement (3 units)	General Education Requirement (3-4 units)

The pathway above is sequenced to encourage students to work with a counselor in choosing some general education requirements to be completed during the first semester. The second, third and fourth semesters are structured for students to complete the calculus series. Also, by putting the major electives in the third and fourth semester, the students have more time to determine where their

interests lie in selecting electives as well as ensuring their chosen electives will be offered in the semester of their choice according to the long-term schedule.

It should be noted that students who are not local to the Ridgecrest area who are pursuing the math degree currently do not have the option to choose Differential Equations as an elective course as it's currently offered only on-ground in Ridgecrest. For some students, this is a concern as they want or need Differential Equations for their chosen field of study. In the past, prospective students from outside of the Ridgecrest area have called inquiring about the program. When they find out that the Differential Equations course is not available online, they look elsewhere for a program. This limits the growth in the number of students in the program and the department needs to address this issue in the near future. However, it should be noted that all students can take Linear Agebra online and meet the 4 unit requirement from Area A and obtain the degree without taking Differential Equations.

5. Conditions of Enrollment

All of the courses in the program have prerequisites. The courses in the pathway are structured to allow students to fulfill course prerequisites and complete the program over four semesters. To maximize access and provide as many opportunities to meet course prerequisites, most of the math courses alternate between on-ground and online delivery mode from semester to semester in the long-term schedule.The prerequisites for the courses are as follows:

Course	Prerequisite
CSCI C251	CSCI C101
CSCI C252	MATH C055
CSCI C265	CSCI C252 or CSCI C251
MATH C121	MATH C055
MATH C121H	Acceptance into Honors Program or eligibility as determined by the instructor
MATH C151	MATH C141, MATH C142
MATH C152	MATH C151
MATH C251	MATH C152
MATH C255	MATH C251
MATH C257	MATH C152
PHYS C111	MATH C151

Part 2—Appropriateness

1. Connection to College Mission

The Math for Transfer Degree Program supports Cerro Coso's mission to provide academic instruction to promote fulfillment of four-year college transfer requirements and encourage degrees. By offering the courses at the IWV campus as well providing access to students at KRV, ESCC and the Tehachapi area via online instruction, the program is in alignment with the college's mission to support student success and acheivement through traditional and distance delivery formats.

The department ensures the quality of the program by tabulating results at least every 5 years in order to complete a formal assessment of the student learning outcomes for each of the math courses required for the degree. If any of the SLOs are found to have success rates below 70%, the department discusses strategies for improvement.

2. Determination of Student Needs

The way the department determines what the learning needs of its students are is through feedback from the students themselves as well as feedback from counselors and administrators. For example, faculty members and counselors may hear from online students about the difficulties students have in traveling to get to proctored exams. So, administration is looking into the possibility of an online exam proctoring service.

Math students also need tutoring services provided outside of the classroom. The department provides direct learning support with the Math Lab staffed by six math faculty at the IWV campus in Ridgecrest. At this campus, in addition to faculty, the department is fortunate to have several quality student peer tutors. At both the Mammoth Lakes and Bishop campuses, a tutor with a doctorate degree in Geology successfully tutors students in math courses at various levels in a Math Lab at those sites. At the KRV campus the full-time math instructor provides tutoring to not only his students, but to those in online math courses as well.

There is currently a need for a full-time Calculus specialist instructor at the Ridgecrest campus in order to permanently sustain the math courses according to the long-term schedule. Students in the program need the support that full-time faculty can offer through ample office hours as well as the mentoring that full-time instructors can provide to complete the program. Currently, the adjunct instructors that teach the Calculus courses each provide 2 hours per week in the math lab. However, due to the fact that they are adjuncts, there is no assurance that they will continue to do so . If the math program is to be an attractive course of study and draw more students into the program as well as support more of these students towards completion, it is important to have this full-time instructor to support the current full-time faculty who routinely work overload semester after semester teaching online or other math courses not in the math program. This is the main reason why currently all on ground Calculus courses

are being taught by adjunct instructors. The department is fortunate to have these quality adjunct instructors who are dedicated to the success of their students.

The department is made aware of the learning needs of students in its program by discussions between students and instructors in the Math Lab as well as discussions between instructors at Math Department meetings. Periodic formal assessment of student learning outcomes and the subsequent department discussions also help to keep the department aware of what the learning needs of the students in its program are.

Lastly, a proctor coordinator supplies validation of exam proctors for online math courses, proctoring services, and verification of student authenticity. This service is a vital part of the online portion of the math program.

3. Place of Program in Curriculum/Similar Programs

Some of the courses in the core of the program are shared in other disciplines or are prerequisites for courses in other programs such as Computer Information Systems, Business Administration, Liberal Arts: Mathematics and Science, and Engineering.

The Math AS-T Degree is an SB 1440 transfer degree. The 15 unit Calculus sequence and elective courses required for the degree constitute the equivalent of the first two years of a Math Program at a four-year university.

4. Majors and Completers

There are 58 students who have self-declared math as their major since March of 2013. Since then, there were three math degrees awarded in 2013, two in 2014, and eight in 2015 for a total of 13 within the last three years. Calculus I (MATH C151) is an entry point into the program and over the last 3 years there has been an average census date enrollment in this course of 95 students per year compared to an average of 4.3 students per year who complete the program. While this may seem to be a very low rate of completers of the math program, it needs to be noted that many students who are not math majors take MATH C151 for other programs, like science and engineering.

With that said, as can be seen in the table below, MATH C151 does have the lowest success and retention rate of all of the math courses over a period of 5 years. Due to the fact that MATH C151 is a prerequisite for all of the other math courses in the program, this does not seem to be unreasonable.

The fact that the success rate is low relative to the retention rate implies that many students who take this course may not be ready for the rigor of a college-level Calculus course.

	1st Day Enroll	Census Enrollmt	Ending Enroll	Students /Section	Retention Rate	Success Rate
CSCIC251	136	123	71	25	57.7%	43.9%
CSCIC252	44	47	41	12	87.2%	72.3%
CSCIC265	118	104	76	21	73.1%	57.7%
MATHC121	1,853	1,512	1,264	29	83.3%	67.3%
MATHC151	594	533	410	31	77.4%	58.7%
MATHC152	318	296	261	21	88.4%	81.6%
MATHC251	172	155	135	17	87.1%	74.2%
MATHC255	51	51	44	10	86.3%	80.4%
MATHC257	76	65	61	13	93.8%	90.8%
PHYSC111	116	114	104	23	91.2%	81.6%

While a little more than 4 students on average per year is probably too few students completing the program, the trend for program completers over the last three years is upward. One of the goals of the department is to increase the number of completers in the program. One way to do this is to draw in more potential math majors. In the Tehachapi area, dual enrollment first and second semester Calculus courses are being offered at Tehachapi High School. This would allow interested students to enter the Cerro Coso Math Program at a level of third semester Calculus. A Probability and Statistics class is also being offered for the first time this semester at the newly opened Cerro Coso Tehachapi Center site. The department will offer a dual enrollment Intermediate Algebra class at Boron High School in Fall 2016. Finally, in Fall 2016, PreCalculus will be offered at the Kern River Valley campus for the first time. If successful, the department would like to implement an on ground PreCalculus course at the Mammoth Lakes and Bishop sites as well. While these are not courses specifically in the math degree program, any students who take these courses have the opportunity to continue taking courses that are in the program via online learning once the connection to math courses at Cerro Coso has been made. By developing community partnerships and offering the courses online as well as on ground, the program is made available to as many students as possible and the department anticipates an increase in the number of completers of the program in the future.

5. Summary of Student Demand Data

Data from 2010 to 2015

	1st Day Enroll	Census Enrollmt	Ending Enroll	Students /Section	Actual FTES	FTEF	FTES/ FTEF
CSCIC251	136	123	71	25	20.4	2.0	10.2
CSCIC252	44	47	41	12	8.9	1.3	6.7
CSCIC265	118	104	76	21	17.7	2.0	8.8
MATHC121	1,853	1,512	1,264	29	197.0	13.6	14.5
MATHC151	594	533	410	31	85.7	5.7	15.1
MATHC152	318	296	261	21	48.2	4.7	10.3
MATHC251	172	155	135	17	25.3	3.0	8.5
MATHC255	51	51	44	10	7.2	1.3	5.4
MATHC257	76	65	61	13	8.2	1.3	6.2
PHYSC111	116	114	104	23	31.7	2.7	11.9

Enrollment in Probability and Statistics (MATH C121) is much higher than the other courses due to the fact that it is required for so many other programs. For this reason, MATH C121 is offered both on ground and online every semester whereas the other core math courses alternate between online and on ground delivery from semester to semester. Another trend in the number of enrollments is that they greatly decrease for the higher level math courses. This most likely is due to a combination of students preparing for other majors as well as attrition. Upper-level elective courses like MATH C255 and MATH C257 with much smaller enrollments work well being offered just once per year in on ground and online formats respectively.

The department has found that demand for distance education courses is fairly consistent from year to year. Just as the enrollments tend to be low in the higher-level courses on ground, the same is true for those classes offered online. For these courses the best fit is to offer the courses minimally once a year in both modalities.

6. Labor Market Information and Analysis *(CTE Programs Only)*

N/A

7. Explanation of Employer Relationship *(CTE Programs Only)*

N/A

8. Advisory Committee *(CTE Programs Only)*

N/A

9. Current Cost of the Program to Students

This degree requires 60 units and will likely take 4 semesters.

CA Residents	Non-residents
60.0 units	
x $46 per unit	x ($200 + $42) per unit
= $2760 in tuition and fees	= $14,520 in tuition and fees
+ ~$3500* for books and supplies	
= $6260 across four semesters or $1565 per semester	= $18,020 across four semesters or $4505 per semester

*This is an estimate. Actual costs will vary.

The cost of textbooks and access codes are inherent to the program. In some cases, a student may be able to save a little money by using an electronic version of the textbook.

The program may be able to cut costs for students dramatically by moving from nearly exclusive usage of Pearson textbooks and access codes into some Open Educational Resource (OER) course materials. The chair of the department attended a workshop at a conference in Sacramento in February 2016 and discovered that OER can save students thousands of dollars in out-of-pocket costs that would otherwise be spent on access codes and textbooks. The department will continue to investigate this option for course materials in the near future.

Although an access code is a requirement for many of the courses in the program, this fee is not currently indicated on the course outline. One possible reason for this is that individual instructors maintain their own individual practice in terms of requiring or simply recommending an access code or textbook. In fact, some instructors provide much of the course content using their own handouts.

Part 3—Currency

1. Staffing

	2012 – 13	2013 – 14	2014 - 15
FTES (students)			
Total	337.3	351.4	314.6
Traditional	196.1	176.7	167.3
Distance Education	141.3	174.7	147.4

FTEF (faculty)			
Total	23.1	24.2	23.1
Traditional	13.9	13.3	13.3
Distance Education	9.3	10.9	9.8
Productivity (FTES/FTEF)			
Total	14.6	14.5	13.6
Traditional	14.1	13.2	12.5
Distance Education	15.2	16.1	15.0
Collegewide Productivity			
Total	14.5	13.6	13.1
Traditional	13.9	13.0	12.4
Distance Education	15.1	14.1	13.9

Over the past 3 years the department has used its five full-time employees to teach all of its online courses. Due to the relocation of a Calculus specialist instructor from the Ridgecrest campus to the Kern River Valley campus, courses in the Calculus sequence at the Ridgecrest campus have been instructed by adjunct instructors exclusively. Thus, if productivity levels for adjunct instructors were compared with productivity levels for full-time instructors for just the courses in the program, it is estimated that they would be about the same. Productivity in terms of FTES/FTEF for all math courses exhibits a small decline over the last 3 years, but to a slightly lesser extent than the college-wide decline in productivity.

Also, while there has been a decline in productivity for traditional delivery mode math courses which mirrors the trend for both delivery modes for the college-wide productivity, the distance education delivery mode in math has remained relatively constant.

Current staffing levels are adequate in the sense that the classes in the long-term schedule are able to run as scheduled each semester; however, there is an immediate need to have a full-time instructor teaching the Calculus courses on ground at the Ridgecrest campus in order to build and sustain the program. Adjunct instructors are currently teaching the classes that demand the most preparation, spending additional time working in the Math Lab, formaly assessing SLOs and are now expected to conduct office hours. While the department is currently fortunate to have some dedicated adjunct math instructors, it does not lend any credibility to a math program to have an instructor leave in the middle of a semester because they receive a better job offer. In order to build a math program and draw

students to that program, it's necessary that students see the higher-level courses being taught by a faculty member who has a long-term stake in the program and the college.

2. Professional Development

Although one member of the Math Department participated in a flex day presentation on Supplemental Instruction (SI), it has been discontinued for the Math Department.

Some math faculty do periodically attend math conferences for individual professional development such as California Mathematics Council (CMC) or other math workshops.

The department has decided to delete the MATH C101 Survey of Math Course from its curriculum as an alternative class to the Intermediate Algebra requirement. In place of MATH C101 will be a Pre- Statistics course (MATH C053) which can serve both as an alternate prerequisite to the MATH C121 transfer- level Statistics course as well as meeting the math graduation requirement for the AA or AS degrees. Members of the Math Department are building this course from scratch but in doing so they have attended conferences and workshops on Statway to gain insights on alternative courses to increase persistence, success, and completion for traditionally underserved students.

Math faculty also meet twice a year to discuss the implementation of new platforms and technologies as well as policies and best practices which integrate the professional development topics presented at FLEX day. For example, over the last academic year, flex day activities have addressed equity and access issues which the math department has participated in.

3. Facilities and Physical Resources

Most of the on ground math classes are taught in the East Wing and thus have access to Smart Room Technology. For online math classes the technology provided by the college is sufficient. Currently the IWV campus is under renovation so the computer science and the physics lab class may have temporary needs. Also, the KRV site no longer has a computer lab. If the Math Department wishes to continue to make the Math Degree an attractive option for students at the KRV site, it would be best to have a facility that has more than just eight computers for the entire campus as is the current situation in the LAC (Learning Assistance Center) at the KRV site.

4. Technology

The math department uses the Pearson Education website for all of its online courses. The department has evaluated other course management systems and feels that MyMathLab and MyStatLab by Pearson are far superior in terms of student and faculty resources. The resources and technology provided by Pearson help maintain integrity and quality, especially in the online program. However, due to the growing concern of increasing financial burden on students to purchase access codes, the department will continue to explore the alternative option of using OER course materials.

Some students routinely use the computers in the computer lab at IWV to do their required online assignments. Students claim that it takes a long time to log in on these computers and that could deter some students from coming into the math lab for help.

In addition to the shortage of computers available to students at the KRV site, there is a need for SmartRoom Technology, which would greatly enhance instruction.

5. Marketing

Over the last year, the campus manager and directors at the Kern River Valley site and East Kern sites have done extensive marketing of the Math offerings at Cerro Coso Community College by contacting the high schools in their service areas. Two sections of dual enrollment college-credit Calculus I and Calculus II are now offered at Tehachapi High School. An evening Statistics course is offered at the Tehachapi Center. A year-long Intermediate Algebra/PreCalculus dual enrollment sequence will be offered at Boron High School in East Kern beginning in fall of 2016. In talking with a math instructor at Burroughs High School, the math department chair learned that there may be an interest in dual enrollment math courses at Burroughs High School in Ridgecrest. The department chair will continue to have conversations with high school instructors and principals in the Ridgecrest and Trona areas to explore the possibility for more dual enrollment math courses in addition to establishing a communication link betweeen the college and the local high schools. By introducing high school students to Cerro Coso math courses, the department hopes to draw more local students into the AS-T Math Degree program.

As for the program description, it clearly specifies the outcomes of the program and accurately informs about the career fields available to completers of the math degree. Course prerequisites and pathways are stated in the course catalog.

I. Part 4 – Student Achievement

1. Course-Level Student Performance Data

Percent Success Rates

	2010-2011	2011-2012	2012-2013	2013-2014	2014-2015	Trend line
CSCI C251	55.6	68.4	50.0	25.9	28.6	
CSCI C252		61.5	76.9	90.0	63.6	
CSCI C265		52.6	40.0	60.0	90.0	
MATH C121	73.1	64.6	63.3	68.8	65.1	
MATH C151	65.5	62.6	45.9	53.1	62.8	
MATH C152	85.0	78.7	86.3	72.5	83.3	
MATH C251	87.9	65.6	82.8	84.6	85.0	
MATH C255	92.3	28.6	88.9	77.8	92.3	
MATH C257	77.8	83.3	100.0	93.8	93.8	
PHYS C111	75.0	73.7	74.2	88.0	95.7	
PROGRAM AVG.	76.5	64.0	70.8	71.4	76.0	
CERRO COSO AVG.	65.0	65.0	67.0	66.0	71.0	

Required Courses: MATH C151, MATH C152, MATH C251, and either MATH C255 or MATH C257

In general, it appears that the success rates for courses in the math program have held steady to just above 70% for each year. There was a dip down to 64% in 2011-2012, but that was due in part to a very low success rate of 28.6% in the Differential Equations course (MATH C255) which was taught by a first-time adjunct instructor. Otherwise, the program average shows a very slight upward trend over time. It should also be noted that there also is no data for the two computer science courses for the 2010-2011 academic year.

Within the last 3 years, the math program success rates have been higher than the college-wide success rates, even though the increase in success has not been as dramatic as the college-wide increase.

Percent Retention Rates

	2010-2011	2011-2012	2012-2013	2013-2014	2014-2015	Trendline
CSCI C251	70.4	73.7	72.7	51.9	28.6	
CSCI C252		84.6	84.6	90.0	90.9	
CSCI C265		73.7	55.0	74.5	100.0	
MATH C121	89.4	86.2	80.1	81.4	77.5	
MATH C151	82.7	79.1	60.0	81.6	79.8	
MATH C152	92.5	86.7	94.1	77.5	87.5	
MATH C251	97.0	63.6	81.3	93.1	92.3	
MATH C255	100.0	42.9	88.9	77.8	100.0	
MATH C257	77.8	91.7	100.0	93.8	100.0	
PHYS C111	81.3	89.5	90.3	92.0	100.0	
Program Avg.	86.4	77.2	80.7	81.4	85.7	
Cerro Coso Avg.	82.0	83.0	83.0	82.0	85.0	

Required Courses: MATH C151, MATH C152, MATH C251, and either MATH C255 or MATH C257

It is not known why there was a dip in retention for courses in the math program in the 2011-2012 academic year when the college-wide retention data did not show this trend. However, the trend since that time has been a slow increase in retention overall in the program.

2. Employment Data *(CTE Programs Only)*

N/A

3. Achievement of Program Learning Outcomes

PLO 1:	*Use the Cartesian, polar, cylindrical, and spherical coordinate systems effectively*
Target:	70%
Assessment Method:	Exam
Assessment Date:	SP16
Recent Results:	**86.4%**
PLO 2:	*Use scalar and vector products in applications.*
Target:	70%
Assessment Method:	Exam
Assessment Date:	SP16
Recent Results:	**88.7%**
PLO 3:	*Use vector-valued functions to describe motion in space.*
Target:	70%
Assessment Method:	Exam
Assessment Date:	SP16
Recent Results:	**89.3%**
PLO 4:	*Extend the concepts of derivatives, differentials, and integrals to include multiple independent variables*
Target:	70%
Assessment Method:	Exam
Assessment Date:	SP16
Recent Results:	**85.3%**
PLO 5:	*Solve simple differential equations of the first and second order*
Target:	70%
Assessment Method:	Exam
Assessment Date:	SP16
Recent Results:	**85.4%**
PLO 6:	*Analyze and model the behaviors of physical phenomena by applying advanced calculus concepts*
Target:	70%
Assessment Method:	Exam
Assessment Date:	SP16
Recent Results:	**86.6%**
PLO 7:	*Apply broad mathematical concepts to practical applications*
Target:	70%
Assessment Method:	Exam
Assessment Date:	SP16
Recent Results:	**76.5%**

		Assessment History Summary					
PLO #	**Target**	**Semester**	**Met?**	**Semester**	**Met?**	**Semester**	**Met?**

PLO 1	70%	SP16	Yes				
PLO 2	70%	SP16	Yes				
PLO 3	70%	SP16	Yes				
PLO 4	70%	SP16	Yes				
PLO 5	70%	SP16	Yes				
PLO 6	70%	SP16	Yes				
PLO 7	70%	SP16	Yes				

a. Gaps and Improvements Made

All PLO targets were met.

b. Summary of Program Learning Outcome Achievement

Student performance in achieving the program learning outcomes (PLO) was determined indirectly by assessment of related student learning outcomes (SLO). For any particular program outcome, there were several student learning outcomes that mapped to the same skill stated in the program outcome. For each PLO, the average of the scores of the student learning outcomes mapping to that PLO exceeded thePLO target of 70%. Overall, students are meeting the program learning outcomes.

Assessing the PLOs by this method has two possible flaws. One shortcoming is that it is difficult to associate to any particular student, or group of students, a designation of having met the PLO target since any particular SLO could have been assessed at any point in the student's pathway. One way to assure that students have the skills stated in the PLOs upon completion of the program is to have an exit exam consisting of skills that directly relate to the PLOs. The second concern is that although the average score of the SLOs pertaining to a PLO met the target, a few SLO scores were below the target.

The department feels that any SLO scoring below 70% needs to be investigated. The department meets twice a year and any SLO scoring below 70% is discussed and improvements are planned. Due to the fact that several of the adjunct instructors are involved with assessing SLOs for courses within the program, adjunct instructors are strongly encouraged to attend department meetings. However, when involved faculty, whether adjunct or full-time are not able to attend a department meeting, follow up by email exchange with the faculty member and the department chair is essential. In the case of some adjunct instructors, this dialog with fellow department members or email exchange serves as the major source of communication about SLOs and assessment.

4. Achievement of Course Student Learning Outcomes

			5-Year Assessment History					
Course	**SLO #**	**Target**	**Semester**	**Met?**	**Semester**	**Met?**	**Semester**	**Met?**
MATH C151	SLO 1	70%	FA15	Yes				
	SLO 2	70%	FA15	Yes				
	SLO 3	70%	FA15	Yes				
	SLO 4	70%	FA15	Yes				
	SLO 5	70%	FA15	No	FA16			
	SLO 6	70%	FA15	No	FA16			
	SLO 7	70%	FA15	Yes				
	SLO 8	70%	FA15	Yes				
Course	**SLO #**	**Target**	**Semester**	**Met?**	**Semester**	**Met?**	**Semester**	**Met?**
MATH C152	SLO 1	70%	SP15	Yes				
	SLO 2	70%	SP15	Yes				
	SLO 3	70%	SP15	Yes				
	SLO 4	70%	SP15	Yes				
	SLO 5	70%	SP15	Yes				
	SLO 6	70%	SP15	Yes				
	SLO 7	70%	SP15	Yes				
	SLO 8	70%	SP15	Yes				
MATH C251	SLO 1	70%	FA15	Yes				
	SLO 2	70%	FA15	Yes				
	SLO 3	70%	FA15	Yes				
	SLO 4	70%	FA15	Yes				
	SLO 5	70%	Not	assessed	FA16			
MATH C255	SLO 1	70%	SP15	Yes				
	SLO 2	70%	SP15	Yes				
	SLO 3	70%	SP15	Yes				
	SLO 4	70%	Not	assessed	SP17			
	SLO 5	70%	SP15	Yes				
	SLO 6	70%	SP15	Yes				
	SLO 7	70%	SP15	Yes				
	SLO 8	70%	SP15	Yes				
	SLO 9	70%	Not	assessed	SP17			
MATH C257	SLO 1	70%	FA15	Yes				
	SLO 2	70%	FA15	Yes				
	SLO 3	70%	FA15	Yes				
	SLO 4	70%	FA15	Yes				
MATH C121	SLO 1	70%	FA14	Yes				
	SLO 2	70%	FA14	Yes				

	SLO 3	70%	FA14	Yes				
	SLO 4	70%	FA14	Yes				
	SLO 5	70%	FA14	No	FA16			
	SLO 6	70%	FA14	No	FA16			
	SLO 7	70%	FA14	No	FA16			
	SLO 8	70%	FA14	No	FA16			
	SLO 9	70%	FA14	Yes				
	SLO 10	70%	FA14	No	FA16			
	SLO 11	70%	FA14	No	FA16			
	SLO 12	70%	FA14	Yes				
	SLO 13	70%	FA14	Yes				
	SLO 14	70%	FA14	Yes				
	SLO 15	70%	FA14	Yes				
	SLO 16	70%	FA14	Yes				

a. Gaps and Improvements Made

MATH C121 All of the SLOs were 70% or better with the exception of:

- SLO 5 Identify the standard methods of obtaining data and identify advantages and disadvantages of each. 63.7%.
- SLO 6 Calculate the mean and variance of a discrete distribution. 67.0%
- SLO 7 Calculate probabilities using normal and student t-distribution **.** 64.9%
- SLO 8 Determine and interpret levels of statistical significance including p-values 56.5%
- SLO 10 Interpret the output of a technology-based statistical analysis. 57.5%
- SLO 11 Select the appropriate technique for testing a hypothesis and interpret the result. 64.1%

The Probability and Statistic course has too many outcomes. The 16 outcomes were put into place in order to match the CID descriptor for this course. However the department has decided to align these 16 outcomes into fewer general SLOs by the next assessment date. This strategy will not only make assessing outcomes easier but will allow some overlap of results of this outcome with other outcomes that were above the target.

MATH C151 All of the SLOs were 70% or better with the exception of:

- SLO 5 Apply the integral in solving for the volume of a body of revolution. 66%
- SLO 6 Apply the integral in finding the center of mass in one and two dimensions. 48.5%

In Fall 2016, these two outcomes will be reassessed. There will be a conscientious effort made by the instructor of the class to spend more class time on these two skills. It will be recommended that the instructor work with students on problems relating to these SLOs in the math lab prior to the reassessment.

MATH C251 All of the SLOs were 70% or better with the exception of:

- SLO 5 Solve simple differential equations of the first and second order. Not assessed.

Communication regarding SLO assessment will be improved within the department. The adjunct instructor who assessed this course assessed several skills that were not SLOs. Before the fall semester begins, discussion within the department regarding the revision of some of the SLOs in the Calculus courses will take place. If it is decided that SLO 5 is to remain as part of the COR (course outline of record), then this SLO will be assessed during the fall 2016 semester.

MATH C255 All of the SLOs were 70% or better with the exception of:

- SLO 4 Demonstrate the interrelationships of real world situations to the ordinary differential equations (ODE's) and model associated applications using formula development, direction fields, and phase lines.
- SLO 9 Perform computations and graphical interpretations using computational and mathematical software.

The same adjunct instructor who assessed the MATH C251 course above assessed the MATH C255 course. These two SLOs were not assessed. The instructor and a senior full-time faculty will discuss whether these two outcomes will be eliminated when the COR is revised this year. If they decide to leave either of these outcomes in place, then the outcome(s) will be assessed in Spring 2017.

b. Summary of Student Learning Outcome Achievement

Overall, the students are achieving the 70% target for most of the SLO assessments in math courses. Although there were a few individual outcomes that fell short of the 70% target, the real concern of the department at this time is to focus on the correct procedure with which to assess SLOs in the future. In this first cycle of SLO assessment, there was a lack of communication among all instructors regarding the assessment of every outcome and not just most of the outcomes. Also, some courses need to be revised

as the current outcomes are either too numerous or in some cases, the outcome has never been assessed. The culture of assessment within the math department is progressing to an awareness among all math faculty of the importance of maintaining consistency and completeness in the assessment process. All faculty members are also beginning to understand the importance of collaborating about strategies for improvement as well as the need to reassess outcomes that fall short of the success targets.

II. Part 5 – Action Plans

1. Analysis of Current Program Strengths

The AS-T Math Degree from Cerro Coso is a rigorous program that will prepare students with the skills they will need to transfer into other related programs at the university level. The core Calculus courses are 5-unit courses that are rigorous and cover the full spectrum of Calculus topics. By keeping a rigorous program the department maintains the integrity of the program. The program is highly accessible to students as the degree is structured so that students can take it entirely online or at the Indian Wells Valley campus. Class sizes in the upper level courses are small so that instructors have enough time to provide the support that students need. The math faculty are dedicated to student success and provide extra support in weekly office hours as well as hours tutoring in the math lab. The program has a long term schedule that is adhered to so that students in the program can plan their pathway to graduation. Finally, not enough can be said for the quality of the instructors. Due to the proximity of the China Lake Base, the college is fortunate to have access to a pool of adjunct instructors that are very knowledgable in math. Many of the SLO assessments in this report were carried out by these hard-working, dedicated professionals. Together with the full-time faculty, this math team continues to serve students and the number of math majors continues to grow each year.

2. Analysis of Improvements Needed

This is the first program review for the AS-T Math Degree. Now that the process has been undertaken and is better understood by some of the stakeholders, there are improvements that need to be made.

The first improvement needed is in the assessment process itself. The math faculty need to work together to design SLO assessments that are the same for all sections of a course. All faculty need to see the big picture of why all SLOs in all sections need to be assessed in a consistent manner. All faculty need to be aware of the proper format to report results in a timely manner. They need to understand that SLOs that do not meet targets need to have strategies put in place for improvement, and then those same SLOs need to be reassessed to evaluate the success of those strategies.

Another improvement is needed in terms of data collection on the declared majors within the program. Currently there does not appear to be any reliable and accessible data on who has declared math as a

major and the progress being made. A simple survey at the beginning of each course could help to identify students who are declared or interested in declaring Math as their major. These students can then be encouraged to meet with the chair of the math department. An institutional researcher specific to Cerro Coso is also needed to help identify and track students in the department. Identifying and tracking students would allow the department to obtain feedback from students about the quality of the program, as well as develop a link of communication between faculty and students to help students finish the program.

3. Three-Year Program Strategies

1. Define an improved SLO assessment process.

Description: The entire math department will agree on an efficient SLO assessment process and then communicate the expectations and procedures to all department members.

Measure of Completion: Common SLO assessments in place across all sections; SLO assessment cycle, reporting format, and implementation of strategies discussed among all faculty at every department meeting; every department member is either present at meetings or approves the minutes. There will be better communication between full-time and adjunct faculty regarding SLO assessment.

Timeline: Fall 2017 to Fall 2020

Roles Responsible: Math Department Chair

2. Collect course progress data specific to students in the Math program.

Description: Instructors of courses in the Math AS-T program administer a simple survey at the beginning of each course to identify students who are declared or interested in declaring Math as their major. The Math Department Chair compiles a list of potential math majors and checks in with these students annually to monitor academic progress.

Measure of Completion: The math chair has a list of self-declared math majors. Self-declared math majors fill out a simple form listing courses in the program they have completed as well as those classes they will take in the future. This form could be completed once per year and done with the oversight of the Counseling Department.

Timeline: Fall 2017 to Fall 2020

Roles Responsible: Math Department Chair

3. Improve PLO Assessment Data Specific to Math Majors

Description: The department collectively decides and implements a method of PLO assessment that will target math majors.

Measure of Completion: One of the two options below is implemented:

a) The department administers an exam that directly addresses the PLOs of the AS-T Math Degree to math majors as they finish the program, or

b) data supplied by an institutional researcher tracks SLO assessments of math majors anonymously as they take courses in the program.

Timeline: Fall 2017 to Fall 2020

Roles Responsible: Math Department Chair/Institutional Researcher

4. Investigate Open Educational Resource materials (OER's) for the Math Program

Description: Faculty will experiment with using (OER) materials in their online courses as the college moves into using the Canvas system. The department will discuss whether to scale up the use of OER materials to include the majority of courses in the program or whether to continue using its current course management system.

Measure of Completion: The Math Department will record the minutes which document the faculty discussion of individual experiences using OERs in online courses as well as the collaborative decision as to whether to fully implement OERs in the program courses or not.

Timeline: Fall 2017 to Fall 2020

Roles Responsible: Full-time Math Faculty

4. Six-Year Program Strategies

1. Increase the number of students that complete the Math program.

Description: The department plans to increase the number of completers of the program by drawing more students into the program and monitoring their progress. The former will be accomplished by offering dual enrollment at high schools within the service area and a sequence of higher-level math courses at the KRV, ESCC and Tehachapi Center sites.

Measure of Completion: There should be an upward trend in the number of self-declared math majors, and completers of the program. There should also be more students coming into the program from other site locations as a result of improved communication within the department about math course sequences that best serve the needs of students at each site. Long-term schedules at the sites will include transfer-level math courses.

Timeline: Fall 2016 – Fall 2022

Roles Responsible: Site Campus Managers and Site full-time math faculty, Math Department Chair

2. Offer Differential Equations in an online modality.

Description: Provide students in the program who are not able to come to IWV the option of taking Differential Equations online. This also provides online students an option for courses from area A.

Measure of Completion: An online Differential Equations course is written and offered.

Timeline: 3 to 5 years

Roles Responsible: Full-time faculty implements online format, Differential Equations Instructor, content expert

3. A full-time math faculty teaches the majority of the on ground Calculus courses.

Description: The Math Department seeks to hire a full-time Calculus specialist for the IWV campus but there is no assurance that a new full-time hire for math will be approved within the next 5 years. Regardless, at least one of the current IWV full-time faculty will gradually transition into teaching the Calculus series of courses.

Measure of Completion: The majority of the Calculus courses are taught by a full-time faculty.

Timeline: 3 to 5 years

Roles Responsible: Full-time Math Faculty

Part 6—Supporting Documentation

The following data is to be supplied by the Office of Institutional Research:

1. **Section Level data by *course* (5 year aggregate broken out online, onsite, combined)**
    a. Number of sections
    b. Enrollment first day, census, end of term
    c. FTES, FTEF, Productivity (FTES/FTEF)
    d. Course Retention Rate
    e. Course Success Rate

f. Method of delivery (F2F, hybrid, ITV, online)

2. **Student Demography by *discipline* (5 years aggregate)**
   a. Headcount
   b. Age
   c. Gender
   d. Ethnicity
3. **Awards (5 years)**
4. **Others as appropriate, in consultation with the Institutional Researcher**

The following data is to be supplied by the department:

1. **SLO Reports for all courses within the program(s) (from CurricUNET)**
2. **PLO Report for each program (from CurricUNET)**
3. **Advisory Committee Meeting minutes *(CTE Only)***
4. **Others, as appropriate, such as department minutes, employer surveys, marketing brochures**