Assessment: Course Four Column

FALL 2015

El Camino: Course SLOs (MATH) - Math (Math and Science Majors)

ECC: MATH 170:Trigonometry

Course SLOs	*Assessment Method Description*	*Results*	*Actions*
SLO #2 SOLVING PROBLEMS - Students will solve trigonometric application problems, including those involving the laws of sines and cosines. **Course SLO Status:** Active **Course SLO Assessment Cycle:** 2015-16 (Fall 2015) **Input Date:** 11/21/2013	**Exam/Test/Quiz -** Bo is ahead of Al in a marathon race as they approach the finish line. A news helicopter hovers 1700 feet directly above the finish line. If the angle of elevation from Al to the helicopter is 38 degrees and the angle of elevation from Bo to the helicopter is 45 degrees, then (a) how far is Bo from the finish line? and (b) how far apart are the runners from each other? **Standard and Target for Success:** Our target for success is 70% with this problem (that is, passing score of 2 or 3 on the following rubric scale: 3 – Complete Understanding – Students solve both parts of the problem correctly and showing appropriate computations. 2 – Most Understanding – Students solve at least one part of the problem correctly. Minor computational errors in	**Semester and Year Assessment Conducted:** 2015-16 (Fall 2015) **Standard Met? :** Standard Met We assessed 10 sections of math 170 this semester. A total of 241 students were assessed. We summarize the results as follows: Score of 3: 127 out of 241 students (that is 52.7%) Score of 2: 53 out of 241 students (that is 22%) Score of 1: 33 out of 241 students (that is 13.7%) Score of 0: 28 out of 241 students (that is 11.6%) Overall, we are pleased with the results. We saw a 74.7% rate of success (scoring 2 or 3). Our target for success for this SLO is met. --- Overall Analysis of Results: Overall we saw good results assessing students' ability to analyze an application problem using trigonometry. Techniques that seem to help include training students to sketch appropriate diagrams and having students work on exercises collaboratively and on the board. To improve these results, we will continue to suggest instructors emphasize conceptual understanding of the mathematical	**Action:** Since we met our standard for success, we would like to follow up using a trigonometry problem that utilizes a different skill set and/or increase the rigor of the assessed problem. (01/16/2017) **Action Category:** SLO/PLO Assessment Process

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	trigonometry might be present. Essentially the problem solving process is on track. 1 – Some understanding – While there is an attempt at utilizing appropriate trigonometry to solve the problem (perhaps the student was able to draw an appropriate sketch), solid understanding is clearly not present. Student might be attempting to apply incorrect trigonometric functions for example or implementing them incorrectly. 0 – No understanding – There is little evidence of any understanding of the topic. The problem is left practically blank (or has nothing of value written).	ideas as well as the computational procedures. Important terminology such as 'angle of depression' or 'angle of elevation' cannot be treated lightly. These terms in conjunction with application problems will help our students improve their performance. --- Instructor Comments: We summarize some instructor comments on their individual class results here: Students had a hard time drawing/labeling the picture. Students had difficulty drawing and labeling the diagram. Results were very good because students were prepared for this type of question on the final exam. Students practiced word problems in class and on homework. To improve results, next time I will assign variety of similar word problems. The students did not meet my expectation, since the success rate was 68%. A helpful method was having students solve problems at their desks. Next time, I will try having students work the problems in pairs and discuss the solution process with each other. The SLO question was on a quiz. The diagram was not provided. Students missed the problem if they did not have the right diagram. This was a result of understanding or not understanding the terms "angles of elevation" or "depression". Once they had the diagram right, most if not all of the students had problem was right. I'll give students more opportunity to work problems themselves, instead of taking notes from the board. I put this SLO question on the final exam. I expected 80% of the class completely got the problem right, yet 75% of them	

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		got it correct. This result is not that bad. To help prepare the students for this SLO, I assigned them homework problems, used a similar problem as an example in lecture, put a similar problem on one of the exams (Exam #3), and put a similar problem on the practice final and I went over that similar problem during the final review. Some students remembered the formula wrong. Some used Definition II for trigonometric functions with an oblique triangle. To improve the results in the future, I have to encourage the students to memorize the Definition II for trigonometric functions. In fact, I have reminded the students several times that Definition II can be used only for a right triangle. In the future, I have to remind them more often that Definition II cannot be used with an oblique triangle. Some didn't set their calculators to degree mode when evaluating tan(45 degrees), for example. Most of the students have a good understanding of right triangle trigonometry. I have given similar right angle triangle questions at the beginning of the semester, and also similar triangle questions (not necessarily right angle) in chapter 7 using the laws of sines, and most of the students did well on that. Just the traditional lecture method. We did a lots of problems from the exercise in the text book. I will push my students to practice more. (01/16/2016) **Faculty Assessment Leader:** G Fry **Faculty Contributing to Assessment:** Pham, Numrich, Georgevich, Eldanaf, Avakyan, Heng, Dammena	

ECC: MATH 180:Pre-Calculus

Course SLOs	*Assessment Method Description*	*Results*	*Actions*
SLO #2 SOLVING PROBLEMS - Students will use polynomial, rational, exponential, logarithmic, and trigonometric equations and functions to set up and solve application and modeling problems. **Course SLO Status:** Active **Course SLO Assessment Cycle:** 2015-16 (Fall 2015) **Input Date:** 11/21/2013	**Exam/Test/Quiz -** A biologist finds that there is an initial bacteria count of 600 in a culture. The relative rate of growth of the bacteria is 30% per hour. (a) Find a function that models the number of bacteria after t hours. (b) What will the bacteria count be after 8 hours? (Round to the nearest whole number.) (c) How many hours will it take for the bacteria count to reach 50,000? (Round to the nearest tenth of an hour.) **Standard and Target for Success:** Our goal this semester is that 70% of these students will score a 2 or a 3 on this SLO using the following rubric: Students will receive a score of 0 - 3 based on the following. Score of 3: Answers all three parts correctly Score of 2: Answers two parts correctly Score of 1: Answers one part correctly Score of 0: Answers no part correctly	**Semester and Year Assessment Conducted:** 2015-16 (Fall 2015) **Standard Met? :** Standard Met There were 8 sections assessing this SLO during Fall 2015. A total of 231 students participated in this SLO assessment. The distribution of scores is as follows: 13.4% earning score of 0 (31 students), 10.4% earning score of 1 (21 students), 18.2% earning score of 2 (42 students), 58.0% earning score of 3 (134 students). The overall success rate is 76.2% (176 students earning a score of 2 or 3). We successfully achieved out target percentage for success. Sec 0874 Since there were 28 students who scored 2 or 3, the success rate was approximately 87%, which is very good. The students exceeded my expectation for their success. I had students work on problems of this type in pairs during class time, in addition to assigning such problems for homework. This proved to be effective, along with having a motivated group of students in the class. Since an 87% success rate will probably not be exceeded, I will assign a more challenging problem the next time that I teach this course. For this assessment, I used the problem that was given. Sec 0862 Most students obtained a score of 2 or 3, so I am pretty happy with the results. I think letting students do practice questions on exponential functions in class was very helpful. I may also ask students to create a problem next time I teach this class. If they can do that, I truly believe that they have learned this topic well. Sec 0860 1. Over half of the students earned a 3 or a 2, but that leaves almost half of the students doing poorly.	**Action:** We will try to continue having students work in class on these problems, give some handouts, and hold more review sessions. (01/15/2017) **Action Category:** Teaching Strategies

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	Reviewer's Comments: All reported results came from the suggested question.	2. I went through several examples in class. 3. In the future I may develop a handout on this topic. Sec 0864 Most students (70.4%)completed this SLO with good understanding. I think that the results could be higher. Exposure to a few more questions of this type would probably be what is needed to bring along those who had shaky understanding. I suspect some are still not sure from reading the question that an exponential model is what is needed here. That would be the emphasis I would place in this next time I teach it. It is rather surprising to me that, since this is a topic that is covered in the pre-requisite class, that a heavier exposure is needed in Math 180, but there it is! One technique I like using for the modeling portion of exponential is to have the students discover the commonality between the financial model for continuous compounding of interest and the relative rate of growth model. Sec 0866 Most students (72.1%)completed this SLO with good understanding. I think that the results could be higher. The students with some understanding could probably be nudged into complete understanding fairly painlessly. Exposure to a few more questions of this type would probably be what is needed to bring along those who had shaky understanding. I suspect some are still not sure from reading the question that an exponential model is what is needed here. Reading for understanding would be the emphasis I would place in this next time I teach it. It is rather surprising to me that, since this is a topic that is covered in the pre-requisite class, that a heavier exposure is needed in Math 180, but there it is! One technique I like using for the modeling portion of exponential is to have the students discover the commonality between the financial model for continuous compounding of interest and the relative rate of growth model. Sec 0882	

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		Students met my expectations on this SLO. Students used academic discourse while teaching each other. Next time I will continue to encourage students to communicate the process of the solution with each other. Sec 0870 My students beyond my expectation for this SLO. During the review, someone asked a very similar question and I think that helped. I went over any problem that they wanted me to on the day of the review. Many came to my review sessions and that also helped. Next time, I will hold even more review sessions. Sec 0872 Some of my students did, but some of them didn't meet my expectation since they don't like world problems. I used webcam, online webassign homework, group work to help in my classroom. I will try mymathlab next semester to see if the results will be improve or not. Overall, the students who participated in this SLO assessment showed that they understood solving application problems fairly well by reaching and surpassing our targeted success rate (70%). As some professors note, having students work on problems in class, whether in groups or alone, was very helpful. Using this strategy, as well as giving handouts and holding more review sessions will hopefully raise the percentage of students scoring 2 or above in the next assessment for this SLO. (01/15/2016) **Faculty Assessment Leader:** Jasmine Ng **Faculty Contributing to Assessment:** J. Ng, M. Georgevich, S. Bickford, A. Avila, N. Koch, C. Huang, B. Lewis	

ECC: MATH 190:Single Variable Calculus and Analytical Geometry I

Course SLOs	*Assessment Method Description*	*Results*	*Actions*
SLO #2 SOLVING PROBLEMS - Solve problems, including problems involving velocity and acceleration, by using derivatives and integrals. **Course SLO Status:** Active **Course SLO Assessment Cycle:** 2015-16 (Fall 2015) **Input Date:** 11/21/2013	**Exam/Test/Quiz -** Sample test problem: A ball is thrown straight up 6 feet from the ground (it is released 6 feet above the ground). When it is released it is traveling at the rate of 100 feet per second. a) Find the velocity function. b) Find the position function. c) How high does the ball go? d) How long does it take for the ball to reach the ground? In this problem the acceleration is that due to gravity. We will use the value 32 feet per second2. We have to worry about the sign of the acceleration. We will take our coordinate system with distance being positive upward. Gravity acts downward. So our acceleration is -32. Our acceleration function is then the constant function a(t) = -32. **Standard and Target for Success:** We set a target of 65% passing the SLO assessment (that is, scoring a 2 or 3 on the rubric scale). We use the following rubric scale: Score of 3 - All 4 parts are solved to completion using proper methods. Student demonstrates complete understanding of the concepts and material. Score of 2 - Student correctly solves 3 parts to completion. Overall,	**Semester and Year Assessment Conducted:** 2015-16 (Fall 2015) **Standard Met? :** Standard Met We assessed 10 sections of Math 190 for this fall 2015 SLO. A total of 232 students were assessed. We have the following results: Scoring a 3 - 100 out of 232 students (43%) Scoring a 2 - 57 out of 232 students (25%) Scoring a 1 - 42 out of 232 students (18%) Scoring a 0 - 33 out of 232 students (14%) We met our target for success. We have 68% of students passing the SLO assessment (scoring a 2 or 3). Overall we are pleased with the results. We hope to push the rate of success to 70% as an action for a future assessment. ---------- Analysis of Results: Looking over the SLO data and instructor comments, we notice some ways in which we were successful and ways in which we can improve the results. Students seem to be proficient in the techniques of taking basic derivatives of functions. The area that students have trouble is the interpretation of the problem and converting the application problem into mathematics. To improve these results, some instructors have suggested utilizing more technology in the classroom (mathematica / visualization software) and/or having students work on their own or in small groups on problems in class. The action of explaining the problems to one another will help bolster their own understanding.	**Action:** We hope to raise the success rate to 70% in a future assessment. Perhaps we will use a different application problem such as related rates to assess calculus problem solving techniques and strategy. (01/20/2017) **Action Category:** SLO/PLO Assessment Process

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	besides minor errors, the student demonstrates competency in using calculus and derivatives applied to projectile motion. Score of 1 - Student solves 1-2 parts to completion. Otherwise, student shows significant gaps in understanding and applying derivatives and calculus to projectile motion problems. Score of 0 - Student is unable to solve any portion of the problem correctly.	---------- Summary of Instructor comments: Three out of five of my students showed complete understanding of the material but nearly a fourth essentially failed the question. I expected a slightly better rate of success given that we did problems involving velocity and acceleration in general and projectile motion with acceleration -32 f/s-squared in particular from day one. The teaching method I used was to explore the examples in the early chapters on average rate of change in detail, many of which involved velocity and acceleration. I had students hand in class work on analogous problems and assigned homework involving those problems in each module as the term progressed. Finally, when we got to definite integration, velocity and acceleration were one of the first examples and a subject we inspected deliberately and in detail. Also, the students were quizzed on velocity and position. As for the future, I may try to use some animation or programming to simulate the problem. The students did satisfactory on this SLO assessment with 67% success rate. I demonstrated a problem similar to this in class and assigned many practice problems before putting it on the exam. I'd like to be able to have them practice a problem in class if time permits to help the students gain a better understanding the next time we conduct this assessment. This SLO question was given as a quiz. 76% (19 students) were able to do the problem. 16% (4 students) made some algebraic mistakes and 8% (2 students) were not able to do the problem. Overall, The results in the quiz show that most of the class were able to use derivatives and integrals to solve velocity and acceleration problems. ANALYSIS: They got it or they didn't. This problem was on the final so they had not seen the material in a while. The	

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		material was presented by substitutes when I was absent due to surgery, so I can't say how the presentation of the material affected the students' understanding. I did give them an acceleration/velocity/position problem on their integration exam, so even though they had not seen this type of problem in a while, we had discussed the topic in general and the relationships between the quantities. Those students listed as "most understanding" pretty much knew what to do but they either just didn't finish the problem (found the times, but then didn't find v(t)) or made bonehead algebra errors (couldn't solve a quadratic equation). Those listed as "some understanding" appeared to understand the relationship between position and velocity, but not much else. The students in the lowest level of understanding did not, for the most part, even apply calculus to the problem. I'm not certain why they didn't try any calculus techniques on a final exam in a calculus course. Their reasoning skills are severely lacking. I'm not certain how some of them made it through intermediate algebra and precalculus. They appear to have no concept of how to approach word problems. Next time I teach this course, I may start off with a day or two covering word problems, maybe some of the ones from my Math 12 class, so that the math won't trip them up, but they can learn the proper way to approach and analyze a problem. To prepare more students for this final exam question, next time I would put it on a midterm exam after covering section 4.9. NOTE: I used the same problem given above, except I changed a few numerical constants so the evaluations could be done without a calculator. 1. Did the students meet your expectation on this SLO?	

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		YES. 2. What teaching method did you use that was particularly helpful? I worked similar examples in class, and I assigned similar problems for homework. 3. What teaching strategy will you try next time to improve the results? I think the results were good, and I will continue using the same strategy. More than half of my students did satisfactory work on this assignment. I did give a similar problem to this and will continue to give additional handouts for added practice. (01/20/2016) **Faculty Assessment Leader:** M Bateman **Faculty Contributing to Assessment:** Bateman, Ho, Numrich, Morales, Sheynshteyn, Hyman, Fogel, Lewis, Hamza, Evensizer	

ECC: MATH 191:Single Variable Calculus and Analytical Geometry II

Course SLOs	*Assessment Method Description*	*Results*	*Actions*
SLO #2 SOLVING PROBLEMS - Students will use integrals to evaluate volumes, surface area and arc length. **Course SLO Status:** Active **Course SLO Assessment Cycle:** 2015-16 (Fall 2015) **Input Date:** 11/21/2013	**Exam/Test/Quiz -** Find the volume of the solid of revolution generated by revolving the region between y=e^x, y=0, x=0, and x=2, around the axis x = -1. **Standard and Target for Success:** Rubric: 0 – No understanding The student is unable to draw a graph illustrating the solid or set up an appropriate integral. 1 - Some understanding The student is able to illustrate the situation and/or identify an appropriate method, but is unable to write down an appropriate integral. 2 –Most understanding The student is able to set up an integral that has only minor problems, or makes a computation error in evaluating the integral. 3- Complete understanding The student is able to set up and correctly evaluate an appropriate integral for the volume. Target for Success: We set a target for 60% of our students to achieve a 2 or 3.	**Semester and Year Assessment Conducted:** 2015-16 (Fall 2015) **Standard Met? :** Standard Met We assessed 7 sections of Math 191 for a total of 207 students. We had 18 students score a 0. This was 8.7% of the student population. We had 56 students score a 1. This was 27.0% of the student population. We had 61 students score a 2. This was 29.5% of the student population. We had 72 students score a 3. This was 34.8% of the student population. Overall the success rate was 64.3%. This means we met our target success rate of 60%. --- Analysis of Results: Central to problem solving for Calculus II is training students to visualize and sketch functions in addition to solids in 3-dimensions. Reinforcing basic concepts from pre-calculus (such as trigonometric functions) can help alleviate some performance issues. Trigonometry is also central to many of the difficult ideas in Calculus II. Without the foundation, we run into trouble. Many instructors have commented that students have trouble setting up the problem while the integration goes pretty smoothly. Using some mathematical visualization software in classes can help bolster student ability to sketch appropriate diagrams and see the solids of revolution actually being generated. Putting students into	**Action:** We would like to improve the success rate to around 65%. Further, we should expand the question to include concepts such as surface area and arclength. (01/29/2017) **Action Category:** SLO/PLO Assessment Process

Course SLOs	Assessment Method Description	Results	Actions

groups can also help them develop their problem solving skills by collaborating and bouncing ideas off each other.

Summary of Instructor Comments:

0944 - Overall the result is good since 77% of the students scored a 2 or 3.
What worked: I went over this concept for 3 hours in class, which correspond to sections 6.2 and 6.3, a study guide was given to practice for the test, and I did two problems similar to the SLO question during the review session the day before the test.
Even though 77% is a good passing rate but to increase that , next time I will warn the students on reading and working the problems on study guide carefully and assigned extra problems on the study guide for them to practice at home.

0946 - My students did not meet my expectation. Many of students in category 1 tried to use “washer method” instead of “shell method”, and they got trapped! I realize that I need to teach my future Math 191 students how to determine when one method is better than the other method through comparison using several examples.

0948 - 1. Did the students meet your expectation on this SLO? Several of my students scored a 1 on this. They did not meet my expectation. Of these students and the 2 who showed no understanding, repeating the course will be necessary and I am unconcerned. However, there are a few who passed the course even with a B. Their grades on this particular skill were poor. They do not seem to have much strength in questions like this that require some conceptual and graphical understanding though they certainly did quite well on skills that required a high level of analytical thinking and processing.
2. What teaching method did you use that was particularly helpful? The students that were successful were

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		able to follow my lead in which I advised them to graph the functions and to draw the cross sections. I made sure they practiced drawing these cross sections. 3. What teaching strategy will you try next time to improve the results? Next time I teach this I plan on giving them a tech assignment in which they will get the computer to generate some visuals. I think this will help the students with weaker conceptual abilities. 0950 - For the volume set up, I think I need to emphasize the concepts better. More manipulatives, more pictures. For integration by parts, the students seem to do very well. I tend to emphasize it and use it often. 0952 - With 63% of the assessed students (20 out of 32) scoring at most or complete understanding, I feel expectations were met for this notoriously difficult topic. Students found the use of multiple examples demonstrated in lecture effective at improving understanding. In the future perhaps using visualization software such as Mathematica to display / construct solids of revolution might help with student understanding of these volume problems. 0954 - Overall, I was very happy with the results especially since they came from the final exam not a midterm quiz. I think I was successful this term since we spent extra time on this topic and focused more on the conceptual elements (sketching the curves, moving the axes, doing problems using both the methods of washer and cylinders) rather than computational questions. 0956 - (1) I purposely put this question on the final exam to verify that they had not forgotten what they were supposed to have learned during the first part of the semester. This question could have been placed on exam one, and the results probably would have been better, but retention was what I was interested in. The fact that about 38% of the	

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		students demonstrated complete understanding seemed reasonable to me. However, that about 47.6% demonstrated either no understanding or some/minimal understanding is intolerable. (2) Sketches are what I emphasize as a critical tool to model problems. It is not enough to try to just memorize formulas and hope that you are applying them properly. In this instance, the 2*PI*r*h*delta_r “formula” for cylindrical shells needs to be applied to the context of the problem at hand. With a proper sketch, and proper understanding, it is obvious that r in this case is x-(-1)=x+1 and that h is e^x and delta_r is delta_x. Using this information to set up the integral, the x*e^x component results in an integration by parts application. This is another thing that I emphasize to my students: REVIEW. Basic integration techniques should not be forgotten. (3) I will definitely be having more quizzes, split evenly between those where they know what the topic is and those where the topic will be a “surprise”, i.e. anything we have previously covered. The class I taught this semester was an evening class, and many of the students who take evening classes do so because they are working full-time. It is also more likely that they have children (one of the students has a daughter that is 3 months old, and many times came to class obviously in need of sleep). Hence, without good time management skills it is very easy for them to get behind in their studies. Early intervention for this group becomes especially important, and I intend focus more on this in the future. (01/25/2016) **Faculty Assessment Leader:** Ben Mitchell **Faculty Contributing to Assessment:** S. Taylor, A. Seyedin, R. Taylor, P. Yun, T. Meyer, Z. Marks, B. Mitchell	

ECC: MATH 210:Introduction to Discrete Structures

Course SLOs	*Assessment Method Description*	*Results*	*Actions*
SLO #2 SOLVING PROBLEMS - Students will use logic, functions, number theory, and combinatorics to solve a variety of problems, including application problems and computer science algorithm analysis. **Course SLO Status:** Active **Course SLO Assessment Cycle:** 2015-16 (Fall 2015) **Input Date:** 11/21/2013	**Exam/Test/Quiz -** (a) Find the gcd(20,637) as a linear combination of 20 and 637. (b) Find the smallest positive inverse of 20 (mod 637) (c) Find the one solution x, with 0 < x < 637, to the linear congruence 20x = 101(mod 637) **Standard and Target for Success:** We set a target success rate of 70% for this SLO (scoring 2 or 3 on the rubric scale). We use the following rubric scale for this SLO test problem: Score of 3 – Student solves all 3 parts of the problem correctly with the correct procedures demonstrated. The student clearly understands the concepts completely. Score of 2 – Student solves 2 of the 3 parts correctly. Computational error(s) might be present but overall the student has strong grasp of the material. Score of 1 – Student solves 1 of the 3 parts correctly. Significant gaps in student understanding of gcd, modular arithmetic number theory ideas are clearly present. Score of 0 – None of the 3 parts are solved correctly.	**Semester and Year Assessment Conducted:** 2015-16 (Fall 2015) **Standard Met? :** Standard Met 1 section of math 210 (23 students) were assessed (the only section offered during fall 2015). Scoring a 3 – 16 out of 23 students (or 70%) Scoring a 2 – 5 out of 23 students (or 21.7%) Scoring a 1 – 2 out of 23 students (or 8.7%) Scoring a 0 – 0 out of 23 students (0%) Overall we see 21 out of 23 students scoring a 2 or 3 – thus a 91% success rate. The target for success is met for this SLO. Analysis of results: The students did very well. Almost everyone showed complete or almost complete understanding. Showing a variety of examples was useful. Assigning an array of problems was useful, too. In the future I will create more examples and more practice problems so that the students can be even more prepared. (01/17/2016) **Faculty Assessment Leader:** G Fry **Faculty Contributing to Assessment:** G Fry	**Action:** We saw a high success rate (91%) for the fall '15 SLO assessment. For future assessment of SLO #2, we would like to possibly increase the rigor of the problem and/or change the nature of the problem to assess a different skill set for discrete mathematics. (01/17/2017) **Action Category:** SLO/PLO Assessment Process

ECC: MATH 220:Multi-Variable Calculus

Course SLOs	*Assessment Method Description*	*Results*	*Actions*
SLO #2 SOLVING PROBLEMS - Students will calculate partial derivatives for a function of more than one variable and use them to solve multivariable optimization problems; and evaluate double and triple integrals, and apply them to physical problems such as moments and centers of mass. **Course SLO Status:** Active **Course SLO Assessment Cycle:** 2015-16 (Fall 2015) **Input Date:** 11/21/2013	**Exam/Test/Quiz -** Students will calculate partial derivatives for a function of more than one variable and use them to solve multivariable optimization problems; and evaluate double and triple integrals, and apply them to physical problems such as moments and centers of mass. Sample Problem: Find the point(s) on the surface (cone) with equation z^2 = x^2 + y^2 that lie closest to the point (4, 2, 0). Hint: We can minimize the distance d easier by considering the square of the distance d^2. Scoring rubric: 0 – Student demonstrates no progress to the solution. 1 – Student determines an appropriate multivariable function for the distance (or distance squared for convenience) from the point to the cone surface. 2 – Student finds appropriate partial derivatives and critical value(s) needed to minimize the distance. 3 – Student solves the problem to completion and provides the correct coordinates of the points of interest. **Standard and Target for Success:** We set a target of 70% rate of success (that is, scoring 2 or 3 on the	**Semester and Year Assessment Conducted:** 2015-16 (Fall 2015) **Standard Met? :** Standard Met We assessed 4 sections of Math 220 for this SLO. We summarize the results as follows: A total of 126 students were assessed. Scoring 3: 65 out of 126 students (or 51.6%) Scoring 2: 39 out of 126 students (or 31%) Scoring 1: 14 out of 126 students (or 11.1%) Scoring 0: 8 out of 126 students (or 6.3%) We are very pleased with the results of the SLO assessment. We had an 83% success rate (students scoring a 2 or 3 on the assessment) --- Analysis of results: Students seemed to meet or exceed expectations with this SLO. Instructors found that utilizing a variety of teaching strategies from traditional lecturing to putting students into collaborative groups helps to strengthen student understanding of applying multivariable calculus. Assigning a variety of homework problems and having students practice the ideas frequently will help to improve future results. Some things we can try for future assessments of this SLO include using math visualizing software in class to generate images and animations of the calculus at work. Optimizing quantities in three-dimensions definitely takes some getting used to and having strong visual aids will help bolster student understanding. --- Some comments left by instructors were as follows:	**Action:** We saw high success rate on the SLO assessment during fall 2015. Thus, for a future assessment of SLO #2, we would like to change the nature of the optimization-type problem to incorporate different skill sets utilized in the multivariable calculus course and/or increase the rigor of the assessed problem. (01/16/2017) **Action Category:** SLO/PLO Assessment Process

Course SLOs	Assessment Method Description	Results	Actions
	rubric scale).	I was pleased with the results and would say that my students did meet my expectations. I find it to be particularly helpful when the students have time in class to collaborate and communicate with each other about their ideas and strategies. It also gives me an opportunity to circulate and interact with them. Having taught this course about 20 times, I thought that the students actually exceeded expectations. I did what I've done all previous times I taught the course. I stand in front of the class and explain the idea clearly, and go over related homework problems when they ask about them. This seems to work pretty well, so I'm planning on staying the course. The students did very well on this question. I was pleased. The students who didn't do enough practice problems didn't do as well. I will create more examples and practice problems. These will have slight variations so that future students have a greater variety of problems to practice outside of class. (01/16/2016) **Faculty Assessment Leader:** Z Marks **Faculty Contributing to Assessment:** Fry, Cohen, Minasian, Stein	

ECC: MATH 270:Differential Equations with Linear Algebra

Course SLOs	*Assessment Method Description*	*Results*	*Actions*
SLO #2 SOLVING PROBLEMS - Students will use differential equations and linear algebra to solve a variety of problems, including application problems. **Course SLO Status:** Active **Course SLO Assessment Cycle:** 2015-16 (Fall 2015) **Input Date:** 11/21/2013	**Exam/Test/Quiz -** Rainbow Pond has a constant volume of 1,000,000 gal. There is an industrial plant on the shore of the pond which has been allowing pollutants to flow into the pond for some time. The industrial plant pumps polluted water into the pond at the rate of 2 gal/min and Iridescent Creek flows out of the pond also at a rate of 2 gal/min. The concentration of pollutants in the effluent from the industrial plant is a constant. Water samples show that currently 10% of the pond water consists of pollutants. (Assume that the water and pollutants in the pond are well mixed.) a) Set up a differential equation to model this situation. Be sure to define all of your variables, as well as any other symbols (e.g. for unknown constants) that you use, completely and carefully. b) Solve your differential equation and find an expression for the amount of pollutants (in gallons) in the pond at any time. (Your solution will contain an unknown constant.) Biologists have determined that for the species depending on the pond water, the pollution level must be decreased to 1% (or less). c) What is the rate that the plant can discharge pollutants if this	**Semester and Year Assessment Conducted:** 2015-16 (Fall 2015) **Standard Met? :** Standard Met Three sections of math 270 were assessed for this SLO. A total of 77 students were assessed. SLO results: Scoring a 3 - 36 out of 77 students (that is, 47%) Scoring a 2 - 26 out of 77 students (that is, 34%) Scoring a 1 - 15 out of 77 students (that is, 19%) Scoring a 0 - 0 students (0%) The target for success is met. We had 62 students (that is, 81%) of students with most to complete understanding. Analysis of Results and comments: With 81% of students assessed at complete or most understanding, overall we are pleased with the results. At this level, students tend to have strong study habits. We continue to emphasize with students the need to work diligently on assigned homework problems. Using collaborative activities in class can help students strengthen their own understanding by explaining the problem solving process and techniques to their peers. We hope to continue emphasizing conceptual understanding of the ideas being studied in addition to the mathematical procedures to help students solve application problems. Instructor Comments: The students did OK, but not as well as I had hoped. No student was totally clueless, but several students did not understand the concept as well as they should have done. We did a variety of application problems in class, but for many students they appeared to concentrate more on the	**Action:** Since we observed an over 80% rate of success, we hope in the future to assess a different variety of differential equations problem (perhaps focusing on a different application such as population dynamics or temperature). Perhaps we increase the rigor of the problem as well. (01/19/2017) **Action Category:** SLO/PLO Assessment Process

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	level is to be reached in 5 years? **Standard and Target for Success:** We set a success target of 65% on this SLO (that is, 65% of students scoring a 2 or 3 on the rubric scale). We use the following rubric scale: Score of 3 - Student solves all 3 parts of the problem correctly. Score of 2 - Student solves 2 of the 3 parts of the problem correctly. Score of 1 - Student solves 1 of the 3 parts of the problem correctly. Score of 0 - Student is unable to solve any portion of the problem.	differences in the problems rather than on the properties they had in common. In the future I would like to be able to spend more time on this topic. I currently spend ½ week on applications of differential equations, but since the course meets only twice a week, this comes to one class period. It would be nice if the students had a chance to try some of the problems and then discuss them in the next class as well, but the time constraints and the amount of material that must be covered make this difficult. The students met my expectations. This is a common differential equation problem in the course. We did examples in class and there were many homework problems that look similar to the SLO question. So I think the students were well-prepared for the SLO assessment. I went through two examples of this type in class thoroughly, and it really helped students understand the process to setup and solve these equations well. (01/19/2016) **Faculty Assessment Leader:** J Evensizer **Faculty Contributing to Assessment:** J Evensizer, A Minasian, J Ng	