Course Outcomes Guide (COG)

Course Title: MAT 204, Calculus II **Date:** Fall 2016, Spring 2017
Course Team: Christopher J. Lewis, Larry Wadel, Adrian Martin

Expected Learning Outcomes
Course Outcomes:
In this course students will acquire:

1) **TECHNICAL COMPETENCY** in the methods of calculus that will enable them to apply the various techniques of integration to evaluate indefinite, definite and improper integrals, and determine arc length, surface area and volume, as well as apply calculus to parametric and polar coordinate equations. Students will be able to apply a variety to tests to determine convergence/divergence of sequences and series. Students will also be able to represent functions by power series, determine intervals to convergence, and provide estimates of error. *(Supports Mathematics Program Outcomes 1, 2,4 and 5)*

2) **CONCEPTUAL UNDERSTANDING** of the formulas, techniques and theory that are developed. Conceptual understanding will be reinforced from numeric, geometric, algebraic and written/verbal perspectives **(The Rule of Four)**. Students will be required to provide heuristic and visual justification of important results. *(Supports Mathematics Program Outcomes 1, 2, 4 5, 6 and 7)*

3) **UTILITY** in the methods of calculus. Students will use calculus to solve applied problems from a variety of disciplines ranging from biology, economics, business, engineering, and the social sciences, but primarily focusing on applications from physics and mathematics. *(Supports Mathematics Program Outcomes 1, 2, 4, 5, 6 and 7)*

Assessment (How do or will students demonstrate achievement of each outcome? Please attach a copy of your assessment electronically.)
Students demonstrate achievement of each outcome by scores on problems from AP Calculus BC exams that are correlated to the learning outcomes.

Validation (What methods have you used or will you use to validate your assessment?)
The mean score for HCC students for each problem is compared to the mean score of the AP Calculus BC test examinees. The comparison is reasonable since AP scores are used to determine college credit.

Results (What do your assessment data show? If you have not yet assessed student achievement of your learning outcomes, when is assessment planned?)

Math 204-01 Fall 2016

Assessment Question	1	2	3	4	5
Learning Outcome	1, 3	2, 3	2, 3	2	1, 3
HCC Mean	5.21	0.53	0.68	0.68	6.78
AP Mean	5.51	0.30	0.56	0.75	4.75
HCC Mean minus AP Mean	-0.30	+0.23	+0.12	-0.07	+2.03

The results indicate that HCC Math 204-01 students were either able to exceed or nearly achieve all learning outcomes, as compared to AP Calculus BC test examinees. This was a highly motivated class of exceptional students. For example, students in this class transferred to such institutions as UMBC in Applied Math, UMCP in Math, Clemson in Physics, West Point in Engineering, and Penn State in Engineering. Three of the students received HCC Commendations for Academic Excellence.

Math 204-01 Spring 2017

Assessment Question	1	2	3	4	5
Learning Outcome	1, 3	2, 3	2, 3	2	1, 3
HCC Mean	2.72	0.61	0.39	0.89	3.22
AP Mean	5.51	0.30	0.56	0.75	4.75
HCC Mean minus AP Mean	-2.79	+0.31	-0.17	+0.14	-1.53

The results indicate that HCC Math 204-01 students were nearly able to achieve learning outcomes with the exception of assessment question 1, where the HCC students scored significantly lower than the AP Calculus BC test examinees. This indicates more work on technical competency and utility, learning outcomes 1 and 3, particularly on problems using arc length to calculate perimeter.

Math 204-02 Spring 2017

Assessment Question	1	2	3	4	5
Learning Outcome	1, 3	2, 3	2, 3	2	1, 3
HCC Mean	4.88	0.71	0.43	0.71	5.86
AP Mean	5.51	0.30	0.56	0.75	4.75
HCC Mean minus AP Mean	-0.63	+0.41	-0.13	-0.04	+1.11

The results indicate that HCC Math 204-02 students were nearly able to achieve all learning outcomes as compared to AP Calculus BC test examinees. The only areas of possible improvement, as indicated by the score on questions 1 and 3, are outcomes 1 and 3, technical proficiency in applying formulas to solve utility problems.

Math 204-S02 Spring 2017

Assessment Question	1	2	3	4	5
Learning Outcome	1, 3	2, 3	2, 3	2	1, 3
HCC Mean	2.33	0.00	0.33	0.67	3.33
AP Mean	5.51	0.30	0.56	0.75	4.75
HCC Mean minus AP Mean	-3.18	-0.30	-0.23	-0.08	-1.42

This was a small class of dual enrolled students at Greencastle HS. Only 3 students completed the assessment. Ordinarily, the low scores would be reason for concern. However, the population was too small to make an accurate prediction. Only 3 students completed the assessment. Since these students are in an AP class, there is little reason to be concerned that they are lacking in exposure to the content on which the assessment is based. Furthermore, the instructor is experienced and capable, with laudatory HCC classroom observations. In the past, even as recent as last year, his students were able to achieve learning outcomes as compared to AP Calculus BC test examinees, with the only areas of possible improvement, as indicated by the score on question 1, are outcomes 1 and 3, technical proficiency in applying formulas to solve utility problems – the same areas in which on-site students could improve.

Follow-up (How have you used or how will you use the data to improve student learning?)
The results indicate that more practice with utility problems that apply arc length formulas to calculate perimeter and revolution formulas to calculate volume would be beneficial to the students.

Budget Justification (What resources are necessary to improve student learning?)
Staff in the Learning Support Center able to conduct formal study groups in Math 204 students.

Course: MAT 204 SLOA Data

	SU 2010	FA 2010	SP 2011	SU 2011	FA 2011	SP 2012	SU 2012	FA 2012	SP 2013	FA 2013	SP 2014
# Active students	5	5	30	9	19	20	11	9	27	16	42
%W	0	20	0	0	5.3	10	0	11.1	4.5	0	4.8
*% walk-away Fs No final exam/grade = F										6.3	4.8
% Success (A,B,C)	80	80	100	77.8	56.3	90	80	42.9	90	75	59.5
Common Comprehensive Final Exam Score			72	71	69	67	72	52	49	**	**
Mean course	2.6	3.25	3.76	2.33	2.07	3.36				2.5	1.93

grade											
Item Analysis **Weakest Content Areas**			SLO 3	SLO 3	SLO 3	SLO 3	None	SLO 1, 2 & 3	SLO 1, 2 & 3	SLO 1 & 3	SLO 1 &3

*% Walk-away Fs = Did not take the final exam and received a grade of F.

** Common Comprehensive Component of the Final Exam provided and analyzed on the COG.

Course: MAT 204 SLOA Data

	FA 2013	SP 2014	FA 2014	SP 2015	FA 2015	SP 2016	FA 2016	SP 2017
# Active students	16	42	22	42	25	35	25	31
%W	0	4.8	18.2	7.1	16.0	8.6	4	6.5
*% walk-away Fs No final exam/grade = F	6.3	4.8	13.6	11.3	8.0	11.4	0	3.2
% Success (A,B,C)	75	59.5	50	54.8	48.0	65.7	60	83.9
Common Comprehensive Final Exam Score	**	**	**	**	**	**	**	**
Mean course grade	2.5	1.93	2.17	1.92	1.64	2.14	2.21	2.76
Item Analysis **Weakest Content Areas**	SLO 1 & 3	SLO 1 &3	none	SLO 1& 3	SLO 1,3	SLO 1,2,3	SLO 1,3	SLO 1,3

*% Walk-away Fs = Did not take the final exam and received a grade of F.

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