Assessment Report 2016-2017

Mathematics (Instructional Degree Program)

B.A. (Degree Level)

Program Mission:
The mission of the Mathematics Program at New Mexico Highlands University is to provide students with a challenging, market relevant and high-quality education in mathematics. Students completing the baccalaureate program in mathematics will be well prepared for their first position in the field. Each mathematics graduate will be capable of independent thought and initiative in the field of mathematics. Each graduate will demonstrate the behavior and attitudes of a professional in the field and be capable of performing the technical tasks required of their field.

Student Learning Outcome 1:

Understanding and demonstrating mastery of basic algebraic skills (Math 120) as well as more advanced algebraic technique and concepts (Math 140).

NMHU Traits Specifically Linked to Student Learning Outcome 1

- Mastery of Content Knowledge and Skills

First Means of Assessment for Outcome 1:

Final grade from Math 120: Intermediate Algebra. Students' mastery will be measured by the cumulative percentage of passing grades for all sections of the course offered in Fall 2016 and Spring 2017.

Summary of Data:

Number of Students Meeting Criterion:	152	Number of Students Not Meeting Criterion:	86
Total Number of Students Assessed:	238	Percent of Students Meeting Criterion:	63.9%

Second Means of Assessment for Outcome 1:

Final grade from Math 140: College Algebra Students mastery will be measured by the cumulative percentage of passing grades for all sections of the course offered in Fall 2016 and Spring 2017.

Summary of Data:

Number of Students Meeting Criterion:	96	Number of Students Not Meeting Criterion:	36
Total Number of Students Assessed:	132	Percent of Students Meeting Criterion:	72.7%

Interpretation of Results for Outcome 1:

64% of students taking Math 120 and 73% of students taking Math 140 in Fall 2016 and Spring 2017 passed these courses respectively. This appears to be a poor result for both Math 120 and Math 140 (almost 40% of 120 students did not pass and nearly 30% of 140 did not pass), though still somewhat consistent with passing rates from other colleges and universities throughout the country. NMHU is an open enrollment university, so often our students are fundamentally challenged with basic, entry-level numeric and algebraic skills. The math department several years ago offered a Math 100 course which attempted to address these deficits. However, current research and studies indicate that requiring fewer developmental courses for students is associated with a higher occurrence of mathematical competence. So the challenge to the mathematics program is to construct a sequence of courses viable for liberal arts students to satisfy core requirements and a sequence of fundamental courses preparing STEM students for higher level study in mathematics and STEM.

Change to Program Based on Results:

(1) The mathematics department is presently working on alternative pedagogic methods and procedures (currently a PLATO software lab is being implemented as an adjunct to lectures) for these courses, as well as creating a liberal arts mathematics course that would be a reasonable alternative to Math 140 (satisfying core requirements) for liberal arts, non-STEM students . Thus, STEM students would be routed to Math 140, whereas non-STEM students, upon completion of Math 120, would be encouraged to take Math 145 (Intro Statistics) or take this to-be-created new liberal arts mathematics course.

(2) This Fall semester 2017 we are running a "STEM-fast" Math 120/140 course. The first four weeks of this course emphasizes topics and concepts in Math 120 and, for those passing an assessment exam in the 4^{th} or 5^{th} week, continues for the balance of the semester with material from Math 140. Those failing to pass the Math 120 assessment criteria in the 4^{th} week will be routed back to a conventional Math 120 course of study. The advantages of the STEMfast course is that STEM students who pass this course can be routed immediately to Math 160, Pre-calculus. This again, is in concert with studies and research that associates this type of accelerated learning with a higher level of mathematical and STEM success.

Effectively (1) and (2) above would mean that non-STEM liberal arts students would be required to take Math 120 and then Math 145 (introductory statistics) or the new liberal

arts mathematics course that is in the process of being created. Whereas STEM students would be placed into the STEMfast math course with the hope that they would be prepared to then enroll in Math 160, Pre-calculus.

Student Learning Outcome 2:

Effectively understand and demonstrate competence and proficiency with analytic geometry, algebraic manipulation of formulas and equations, rates of change and applications of the derivative and the integral; effectively be able to write proofs in Math 317.

NMHU Traits Specifically Linked to Student Learning Outcome 2

- Critical and Analytic Thinking Skills
- Algebraic Competence

First Means of Assessment for Outcome 2:
Math 211: Calculus 1 Students' ability to successfully demonstrate proficiency with the topics and concepts in this course will be measured by an achievement of a passing grade.

Summary of Data

Number of Students Meeting Criterion:	39	Number of Students Not Meeting Criterion:	10
Total Number of Students Assessed:	49	Percent of Students Meeting Criterion:	79.6%

Second Means of Assessment for Outcome 2:

Math 252: Calculus 2. Students' ability to successfully demonstrate proficiency with the topics and concepts in this course will be measured by the achievement of a passing grade.

Summary of Data:

Number of Students Meeting Criterion:	18	Number of Students Not Meeting Criterion:	4
Total Number of Students Assessed:	22	Percent of Students Meeting Criterion:	81.8%

Third Means of Assessment for Outcome 2:

Math 317: Discrete Mathematics. Students' ability to successfully demonstrate proficiency with the topics and concepts in this course will be measured by the achievement of a passing grade.

Summary of Data:

Number of Students Meeting Criterion:	7	Number of Students Not Meeting Criterion:	4
Total Number of Students Assessed:	11	Percent of Students Meeting Criterion:	63.6%

Interpretation of Results for Outcome 2:

Mathematics and STEM students are doing well with the material in these courses There is evidence of evolved mathematical maturity insofar as effectively communicating solutions to problems and constructing logical arguments in writing proofs for Math 317. These courses are a bridge to the higher level, more advanced courses offered for the major.

Student Learning Outcome 3:

Effectively process more abstract and theoretical mathematical ideas and concepts, and effectively construct and write mathematical proofs associated with these concepts.

NMHU Traits Specifically Linked to Student Learning Outcome 3

- Mastery and Interpretation of Abstract Analytic Mathematical Concepts
- Mastery of Content Knowledge and Skills
- Critical and Reflective Thinking Skills

First Means of Assessment for Outcome 3:

Math 425: Introduction to Real Analysis: Students ability to construct and transcribe meaningful and logically correct mathematical proofs, as well as processing abstract theoretical concepts and ideas will be measured by the achievement of a passing grade.

Summary of Data

Number of Students Meeting Criterion:	2	Number of Students Not Meeting Criterion:	0
Total Number of Students Assessed:	2	Percent of Students Meeting Criterion:	100.0%

Second Means of Assessment for Outcome 3:
Math 421: Applied Abstract Algebra: Similar to Math 425, students are asked to construct mathematical proofs in relation to concepts involving abstract algebraic structures. Student's ability to demonstrate mastery of proof-writing and abstract interpretive skills will be measured by the achievement of a passing grade.

Summary of Data

Number of Students Meeting Criterion:	1	Number of Students Not Meeting Criterion:	3
Total Number of Students Assessed:	4	Percent of Students Meeting Criterion:	25.0%

Interpretation of Results for Outcome 3:

Math 425 and Math 421 will be the designated courses to assess proficiency and competence for mathematics major.

In Math 425 (Real Analysis), despite low enrollment, results are commonly mixed. In the previous academic year, 50% of students successfully demonstrated competence. In this particular academic year F16 – SP17, all 2 students in this course passed. One did very well, the other student struggled to a greater degree (nevertheless passing the course). Of course, it's rather difficult to assess a trend or overall success rate in the math program, here at Highlands University, with so few students enrolled year to year. It's significant to point out that students taking equivalent Real Analysis courses at larger colleges and universities, experience similar difficulties with the material as the students in our courses.

The results for Math 421 (Applied Abstract Algebra) this last academic year were poor. Only 25% of the students passed the course. This is a disappointing result, though consistent with results from previous years.

Both Math 425 and Math 421 demand and require a great degree of intellectual rigor and organization of abstract thought. Transcribing mathematical proofs is the format for which we evaluate students' mastery of these traits.

Change to Program Based on Results:

The math department is now in the process of creating a course which will be serve as an introduction to mathematical abstraction and proof writing. This will be a required 300-level course (for mathematics majors) and seen as a necessary gateway to the more advanced proof-writing courses such as Math 425 and Math 421 (as well as other higher level 400-level courses such as Math 401 (Discrete Chaos and Fractals), College Geometry (now offered as a special topics course), Math 444 (Matrix Theory)). Proof-writing technique and an experience with more abstract concepts appearing in higher level courses will be emphasized.