Eastern West Virginia Community and Technical College
COURSE ASSESSMENT REPORT

Course Title and Number: MTH 135 College Algebra	**Academic Term and Year of Assessment Activity (Ex: Fall, 2010): Spring 2013**
Report Submitted By: Marie Van Meter	**Number of Students Assessed: 21**
Date Report Submitted: 5/21/2013	**Number of Sections Included: 2**
Course Delivery Format (list all modalities used in sections assessed. Ex: web based, VDL, traditional section, hybrid course, etc.): Traditional section with online supplement (MyMathLab)	

Course Role in the Curriculum
Provide a description of the role the course serves in the curriculum (i.e. general education requirement, program technical core, restricted elective, etc.). Note all as appropriate.

MTH 135 College Algebra is a general education core taken primarily by students in the Associate in Science track or by those who will transfer to a four-year program of study requiring College Algebra. At Eastern, Math 123 Intermediate Algebra or satisfactory placement scores are prerequisite to College Algebra.

Assessment Methods
Provide a description of the assessment process used. Include description of instrument and performance standards in description. Note all methods.

This assessment is based on embedded final exam questions chosen by the two instructors prior to the exams. The sections differed greatly in the method of testing, in the prior math instruction of the students, and in the class size.
*** The lead instructor tested within MyMathLab online (but taken in class). She embedded online questions as similar as possible to those selected by the adjunct. The adjunct gave paper-based finals. This use of embedded, comparable final exam questions takes into account that the high school section was carefully screened with either an Accuplacer algebra score of 112 or an ACT Math score of 121 (less than the Catalog requirement of 123?), whereas the adults had only to achieve a D or better in Math 123 to enroll. The high school students had little training in the mathematical modeling approach and the use of graphing calculators, whereas the adult students had extensive preparation in these areas during Math 123.
*** This question selection method gives the instructors flexibility in the instructional time allocated to weak areas and allows final exam questions to be customized to the content emphasized in a particular class, but all are held to the same standards for assessment.
*** The last assessment of MTH 135 was in the Fall of 2008. In the past, some high school sections of MTH 135 taught by adjuncts were not assessed at all. A common final exam created by the math department would make assessment easier, but the embedding of pre-selected questions agreed upon by the instructors coupled with a review of test paperwork and online statistics by the lead instructor serves as a quality control.

Assessment Results
Provide a summary of results including tables/charts. Incorporate information from previous assessments as appropriate. Append additional pages if necessary. If appending, include notation in box to "See attached".

The performance standard of 75% completely correct responses was not met on *any* of the four preselected final exam questions. Three of the questions were from the last half of the course with one being from the last two weeks. An overview of results from the online finals of the larger section suggests that the questions selected for assessment may not have been representative of the overall achievement, but performance on the selected topics is a concern.

*A detailed discussion of the questions, the causes of errors, and suggestions for improvement or course modification are appended to this report in **Attachment 1**.*

In the high school section, the average score on the first part of the final (Chapters 1 through 4) was 86% with a median of 93%. The high school average on part two (Chapters 5 through 8) was 79% with a median of 80%. For the adult section, the average on the combined exam was 53% with a median of 49% before the scores were supplemented with points for doing a practice exam. Since the final exam counts just 20% of the course grade, only two students actually failed, and two received D's.

Course Level Assessment Summary of Outcomes, Indicators and Results MTH 135 College Algebra Number of students in assessment sample = 21 Number of Sections in Assessment = 2 Add additional rows to table if necessary				
Learning Outcomes (Insert learning outcomes assessed during this cycle)	**Indicator** (Insert indicators used for each outcome: exam question, scoring rubric, etc. Be specific)	**Percent of Correct Responses**	**Percent of Incorrect Responses**	**Performance Standard Met (75%)* (yes or no)**
Outcome 1: Solve systems of linear equations using substitution, elimination, or matrix methods (3 different objectives in Master Course Record)	Final exam questions: (*offline*) Solve the system of equations using row-echelon form and backward substitution: $x - y - z = 7$ $2x + y - 2z = 11$ $3x - y + 2z = -11$ (*online*) Solve the given system of equations: $x - y = 4$ $4x - 3z = 24$ $4y + z = 8$	43%	57%	No
Outcome 2: Form composite functions	Final exam questions. (*offline*) If $f(x) = \sqrt{3 - x}$ and $g(x) = x^2 + 3$, find $(g \circ f)(x)$. (*online*) Use the given f(x) and g(x), to evaluate each expression: $f(x) = \sqrt{x + 26}$ and $g(x) = x^2$. a. $(f \circ g)(6) = $ b. $(g \circ f)(-5) = $	29%	71%	No

Outcome 3: Solve exponential equations	Final exam questions: (*offline*) Solve $9 - 4e^x = 2$. Round your answer to the nearest thousandth. (*online*) Use natural logarithms to solve the exponential equation symbolically. $1.6e^{-1.4x} = 1$ Round to the nearest thousandth.	52%	48%	No
Outcome 4: Analyze series	Final exam questions: (*offline*) Find the sum of the infinite geometric series: $2 - \frac{2}{3} + \frac{2}{9} - \frac{2}{27} + \frac{2}{81} - \frac{2}{243} + \ldots$ (*online*) Evaluate the infinite geometric series to find the sum, if possible. $\frac{1}{7} - \frac{1}{49} + \frac{1}{343} - \ldots$	19%	81%	No

* Please note if using a different minimum performance standard.

Conclusions and Action Plan
Provide a brief summary of conclusions derived based on analysis of data. Identify action plan for improvement or maintaining current performance levels. Append additional pages if necessary. If appending, include notation in box to "See attached".
The achievement on the embedded questions was not up to the standard. Over a third of the questions would have met the 75% criteria with many others receiving partial credit for minor mistakes. Several factors probably contributed to these poor results. First of all, the high school section was not nearly as well prepared as the previous year, nor apparently was the adult section. It is true that the preparedness varies for year to year so this should be monitored over time. Requests to meet with the math department head at the high school have been disregarded for over two years. With the State implementing a new math curriculum sequence, we do not know what math skills incoming students will already have mastered. Care should be taken in placement to adhere to the Catalog prerequisites. When the enrollment standards are lowered, instructional time is diverted to the less prepared students, and quality of instruction is compromised. Second, having the class on Mondays and Wednesdays at the high school resulted in frequent

schedule shifting due to no classes on Mondays (teacher or vacation days). That has been remedied for next Spring by placing the class on the TR cycle. There was an overly long Easter break of 1 ½ weeks that resulted in poor retention of subject matter.

Third, it appears that there is too much content to be covered in Math 135. The first chapters are primarily review for the high school students but not for those coming to the class with low averages from Math 123. If more review could be incorporated into both written and lab assignments just prior to the need for the skills, time could be freed up from the teaching schedule by omitting what, for most, is review.

It may be time to edit the Master Course Record for Math 135. First of all, the new State CTC guideline for "Intermediate Algebra," whether college-level credit or not, may eliminate some of the content at that level. Thus the prerequisite to College Algebra will not teach as many of the math skills as in the past. Second, Eastern's Math 135 College Algebra contains topics that are not covered by WVU (and its division at Keyser, WV). These are discussed at the end of Attachment 1. A hyperlink to WVU's Math 126 College Algebra 3-day is included there. Eliminating parts of conic sections and the miscellaneous topics in the last chapter would allow for more in-depth instruction in the topics essential to those needing this subject for their program or for transfer. **See Attachment 2 for comments from Math 135 instructor Andrea Williams on the MCR for this course.**

Effective Date for Changes or Curriculum Proposal Submission to LOT (if recommended)	Proposed Date for Reassessment
	Spring 2015

Assessment Committee Approval (To be posted by Assessment Committee Chair)	LOT Review (To be posted by Assessment Committee Chair)
Date: June 12, 2013	Date: June 17, 2013

Attachment 1: Analysis of responses to embedded questions

Objective 1: **Solve systems of linear equations** involved a system of three equations in three unknowns. The high school section were taught the symbolic method for two-variable systems, but shown mostly the matrix method (use of calculator feature) for three-variable systems with a greater emphasis on translating word problems into systems of equations. The adult section studied symbolic solutions more intensively.

Nine of the 21 students were successful in solving the system with appropriate work display. Six more got partial credit. Mistakes included signed number computational errors, applying an incorrect method such as trying to invert an augmented matrix, and failing to complete an otherwise correct process. The remaining six either did not attempt the question or attempted an inappropriate symbolic method.

Since the symbolic method can be time consuming for a system of three equations in three unknowns and susceptible to arithmetic errors, it may be better to test this skill through application of matrix methods with an emphasis on translating word problems. Chapter tests might be the appropriate place for incorporating linear systems when a symbolic solution method is to be used. At the College Algebra level, emphasis on modeling and applications is more needed. Emphasis on "word problems" is one way to reinforce reading and writing skills for Eastern students.

Objective 2: **Form composite functions** had two versions, one to create a formula for the composition and one to evaluate for a particular value of the variable. The second version could be done with or without creating the composite formula. Six of 21 students gave entirely correct responses. Two set up the formula correctly but failed to simplify symbolically. Seven students either performed a function multiplication instead of a composition or reversed the order of the composition. Two made minor computational errors. Four students either did not attempt or did not give a meaningful "solution."

Since function composition is a prerequisite to the introduction of inverse functions and logarithms, this skill deserves more practice when it is introduced. One-third of the students were unable to recognize the notation and/or to do the sequential operations in the correct order ("f *of* g *of* x" first applies the function *g* to *x*, then applies the function *f* to the resulting value or formula. This is to some extent a misreading of the preposition "of.")

Objective 3: **Solve exponential equations.** Eleven of 21 students displayed entirely correct answers. Three did not apply the needed *ln* function, using *log* instead. Six made minor computation errors but displayed correct work until the last one or two steps. Only one showed no comprehension.

The use of the natural number *e* and the natural logarithm *ln* were new to most of the students. This was one of the last topics covered and was certainly not mastered. Checking symbolic solutions with graphical ones could be stressed to help catch mistakes. Since some mistakes were elementary mistakes in arithmetic or solving equations, incorporating more review of such topics in the labs would help. Consideration needs to be given, too, to how many days are devoted to topics at the beginning of the book that have been taught in either Math 96 or Math 123. If review work were incorporated throughout the labs and not assigned to instructional days, more thorough coverage of the material at the end of the text would result.

Objective 4: **Analyze series.** Each of the embedded questions was to determine the sum of an infinite geometric series with terms of alternating signs. The high school students were allowed to use a self-created formula card; the adult students received a formula sheet from the instructor. The formula for the sum of an infinite geometric series requires that the student determine the common ratio from one term to the next in the series, identify the starting term, and often simplify a complex fraction algebraically or with a calculator. The formula itself is relatively simple to apply.

Only four of 21 got the infinite geometric question entirely correct. This was the next to the last topic covered and was not mastered. Three students did not even try in spite of having the formulas available. There was no trend in the reasons for incorrect responses except that mental fraction math was the easiest way to determine the common ratio and to simplify the resulting complex fraction. Even so, the graphing calculator could have been used to identify the common ratio and to simplify the complex fraction. Many of the students missed the question because they tried to use formulas for the sum of a finite series or merely identified the next term in the series.

If sequences and series are to be taught in Eastern's Math 135, more time needs to be devoted to the topic and more labs assigned. This topic is typically part of the last chapter in college algebra textbooks along with counting, the binomial theorem, probability and mathematical induction. It is often omitted when classes are cancelled due to weather. For comparison, note that these topics are not included in WVU's College Algebra class at all. In fact, even conic sections other than the circle are omitted by WVU. Information on WVU's College Algebra and a sample syllabus from Fall 2012 are located at http://www.iml.sitespace.wvu.edu/math_126 and http://www.iml.sitespace.wvu.edu/r/download/139977 . Consideration should be given to making this topic optional or possibly "extra credit" so that more time may be devoted to the remaining content.

Attachment 2: Comments from Andrea Williams, the Spring 2013 Math 135 instructor for the adult section at Moorefield

From:	Andrea Williams
Sent:	Wednesday, May 22, 2013 10:13 PM
To:	Marie VanMeter
Subject:	RE: research paper to peruse in your "spare" time

Hi Marie,

I agree 100% with what you said in the course assessment about "too much content"! This past semester I avoided any topics not on the course outcomes list (unless prerequisites to something on the list), spent as little time as possible on topics they should have known from 123, and resorted to a couple of take-home tests, and I still didn't have time for everything. I think if we could just eliminate all the objectives from Chapters 7 and 8 (which students who go on to take more math classes would likely see in a precalculus course), the rest of the material could be covered at a reasonable pace. I actually took 126 through WVU as a senior in high school, and, looking back through my notes, the content we covered lines up pretty well with Chapters 1 through 6 of our textbook.

Andrea

From: Marie VanMeter
Sent: Wednesday, May 22, 2013 11:05 AM
To: Andrea Williams
Subject: research paper to peruse in your "spare" time

Andrea, This research article by WVU faculty may be of interest to you as you work with Math 135 and assessment over the next few years. It may give you some ideas on how to motivate and improve Math 135.
Laura Pyzdrowski deals with the lower level math instruction and labs at WVU and does a lot of research on math education.

http://www.math.wvu.edu/~mays/Papers/Exploring%20the%20Feasibility%20of%20Dual-Credit%20Mathematics%20Courses%20in%20High%20School%20via%20a%20Web-Enhanced,%20Blended%20Model.pdf

Marie