

Course Level Assessment

**Intermediate Algebra – MTH 123
Fall 2007**

**8 April 2008
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Approved by Learner Outcomes Team May 16, 2008

Introduction

The purpose of this report is to present the methodology and findings for the course level assessment of Intermediate Algebra (MTH 123) during the fall 2007 semester. Intermediate Algebra serves as a college level course that meets the degree requirements for all programs at Eastern. This course presents fundamental algebraic concepts providing students with the foundation to advance to higher level mathematic courses or meet a 2-year degree requirement. To assure that Intermediate Algebra is meeting its intended purpose in the curriculum and that students are in fact achieving the defined course learning outcomes identified on the Master Course Record Form (See Attachment A), this course was selected for an ongoing course level assessment project to discern attainment of specified learning outcomes across multiple class sections. Instructors of Intermediate Algebra provided input as to which course outcomes to include in this assessment.

Methodology

Intermediate Algebra course outcomes will be assessed on a cyclical basis over three years beginning with the fall 2007 semester. Each year, a minimum of four course learning outcomes will be selected for evaluation. Dependent upon assessment findings, some outcomes will be assessed over multiple years to validate effectiveness of changes in curriculum or course materials. Exam questions addressing the target learning outcomes serve as indicators of student attainment of course learning outcomes. These exam questions are incorporated across all sections of MTH 123 during the assessment cycle. The minimum performance standard is set at 80%. At least 80% of the students completing the common indicators administered via the course examination will provide

the correct response. In the event that the minimum performance standard is not met, the unmet learning outcome will be targeted for further monitoring. The results may also trigger an evaluation of course materials supporting the learning outcome, revision of course materials or further curriculum revision.

In the fall 2007 semester, four course learning outcomes were selected for assessment in all sections of Intermediate Algebra. The target learning outcomes include:

- Outcome 1: Graph parabolas
- Outcome 2: Solve linear applications
- Outcome 3: Use rules of exponents
- Outcome 4: Solve systems of linear equations

To assess these learning outcomes standard questions were administered in two sections of Intermediate Algebra. All students enrolled in these sections completed the standard questions. Fourteen students were included in this sample. The outcomes and corresponding indicators are listed in Figure 1. Results were compiled for each indicator denoting the percent of student's response for each indicator as scored using a rubric.

Findings from the data for each outcome are presented in the results section of this report.

Learning Outcome	Indicator
Outcome 1: Graph parabolas	O13. Graph the parabola and label the coordinates of the vertex. $y = -(x + 7)^2 + 4$ O14. Graph the parabola and label the coordinates of the vertex. Find the x-intercepts(s) and y-intercept, if they exist. $y = x^2 + 7x + 6$

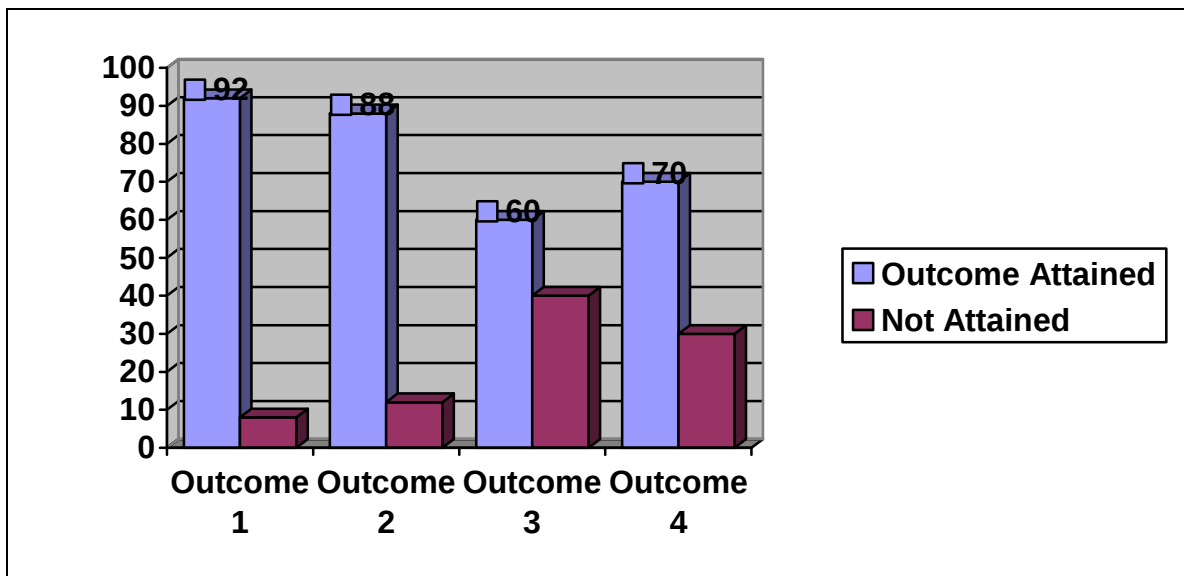
Outcome 2: Solve linear applications	9. The linear equation $y = -3,000x + 13,500$ can be used to approximate the resale value of a pickup truck in dollars, where x represents the number of years after its initial purchase. Find the y-intercept of this line, and interpret its meaning in the context of this problem. 10. A tool rental store charges a flat fee of \$6.50 to rent a chain saw and \$3.00 for each day, including the first. If you need to rent the saw and absolutely refuse to spend more than \$36.50, what's the maximum number of days you can keep the saw? 15. A new sports car, the Revolution, can be leased for \$3,000 down and \$300 per month, so that the cost of leasing is given by $y = 3000 + 300x$, where x is the length of the lease in months. The same dealership offers the Yachtsman, a luxury car, for \$5,000 down and \$260 per month. After how many months would the total cost of leasing the two cars be equal? 19. For over 20 years, the population of Tressel, Ohio has been increasing linearly according to the function $P(t) = 350t + 9,000$ where P is the number of residents, and t is years after 1980. Compute $P(0)$ and interpret its meaning in the context of this problem. 20. At one college, a study found that the average grade point average decreased linearly according to the function $g(h) = 3.00 - 0.15h$ where h is the number of hours per week spent watching reality shows on television. Compute $g(5)$ and interpret its meaning.
Outcome 3 : Use rules of exponents	O7. Simplify the expression by using the properties of rational exponents. Assume all variables represent positive real numbers. Express the final answer using positive exponents only.
Outcome # 4: Solve systems of linear equations	11. Solve the system using the graphing method: $y = 3x + 5$, $2y - 6x = 8$ 12. Solve the system using the substitution method: $x = 4y + 16$, $2y + x = 10$ 13. Solve the system using the addition method: $x + 2y = 21$, $-4x + 8y = 28$

Figure 1: Assessed Outcomes and Indicators
 (Questions with an O in the numbering were a part of an online exam)

Results

Based on the existing data, two of the four learning outcomes were successful at the minimum performance standard (See Table 1). Ninety-two percent of the students successfully completed the identified indicator for Learning Outcome 1 (Graph parabolas) and eighty-eight percent of the students successfully completed the indicator for Learning Outcome 2 (Solve linear applications). The remaining two outcomes failed to meet the minimum performance standard established for the assessment activity. The performance of the two learning outcomes not meeting the minimum performance standard are sixty percent unsuccessfully completed the indicator for Learning Outcome 3 (Use rules of exponents) and Learning Outcome 4 (Solve systems of linear equations) was just below the target of eighty percent at seventy percent.

Table 1: Distribution of Performance Standards for Outcomes 1 Through 4



Outcome 1: Graph parabolas

Two questions were included on the final exam covering this outcome (Figure 1). The percentage awarded for correct responses was 92% which is above the desired 80% attainment level. An online lab component to supplement in class instruction was incorporated during the fall 2007 semester. The online lab which accompanies the text has tutorial based questioning for the students to access to enhance their in-class lessons. These step-by-step tutorials could also have the effect of leading to these positive results this semester.

Outcome 2: Solve linear applications

Five questions were included on the final exam covering this outcome (Figure 1). The percentage awarded for correct responses was 88% which is above the desired 80% attainment level. This outcome met the attainment level for this course.

Outcome 3: Use rules of exponents

One question was included on the final exam covering this outcome (Figure 1). The percentage awarded for correct responses was 60% which is below the desired 80% attainment level. One section of Intermediate Algebra performed well on this outcome whereas the second class performed poorly. Upon inspection of the students work on this outcome, it appears that the poorly performing class all committed a similar error in calculations. A possible reason could be an ineffective teaching demonstration of this topic for this class.

Outcome 4: Solve systems of linear equations

Three questions were included on the final exam covering this outcome (Figure 1). The percentage awarded for correct responses was 70% which is slightly below the

desired 80% attainment level. The students were to solve each of the three questions using a different method. Most students were able to successfully solve a system of equations using one of the method, but not necessarily by using the other two methods. In particular, the graphing method garnered the fewest correct responses.

Conclusion and Action Plan

In conclusion, this course level assessment of Intermediate Algebra for fall 2007 finds that two of the four outcomes are not being met at the minimum performance standard of 80%. For Outcome 3 (Use rules of exponents) only 60% of the students answered the question correctly based on rubric scoring. After review of the exam question on this outcome, one section of students performed well while the second section did not perform as well. There may have been less attention to this outcome in the low performing section or maybe no follow up to assigned problems to assist students to take corrective action. This outcome will be examined in the next semester to determine if any action needs to be taken to strengthen the performance level. No changes to the course will be implemented at this time. Once more data are collected, a decision can be made if any instructional changes need to occur.

Outcome 4 (Solve systems of linear equations) also did not meet the minimum standard of 80% correct responses. It came in at 70%, which is slightly below the attainment level. Out of the three exam questions that covered this outcome, one appeared to be answered incorrectly more than the other two. Plans are to emphasize the graphing method of solving systems of linear equations in the next sections of Intermediate Algebra. In addition to this emphasis, graphing linear equations will be

analyzed in the next evaluation of this course to insure that it receives the emphasis that will enable students to be successful in all related outcomes.

Outcome 1 (Graph parabolas) did meet the minimum performance standard in this course. This does confirm that outcomes that include graphing equations are being met with success. Outcome 2 (Solve linear applications) also met the minimum performance standard in this course. While follow up will be done to insure student success in graphing linear equations, based on the success of outcome 1 & 2, no changes in the content or instructional methods are recommended at this time. The continuation of the online tutorials will provide further strengthening of students ability to master application problems in this and their future Math course work.

The participating faculty members have been made aware of the course level assessment and attainment of the outcomes for the classes they taught. Their continued input as to which outcomes to monitor will be utilized in future course level assessments.

**Eastern WV Community & Technical College
Master Course Record**

Course Prefix and Number: MTH 123
Course Title: Intermediate Algebra
Recommended Transcript Title Intermediate Algebra
Date Approved/Revised 30 June 2005
Credit Hours: 3 Contact hours per week (Based on 15 week term): Lecture: 3 Lab:
Prerequisite: RDG 090, MTH 95 and MTH 96 OR MTH 099 OR minimum acceptable test scores for placement in college-level math: 1) Math ACT score 19 or higher; 2) SAT math score 460 or higher; 3) Introductory Algebra Placement Exam score 80% or higher. Co requisite: Pre/Co requisite:
Grading Mode: Letter Grade
Catalog Description: This course covers a study of linear and absolute value equations and inequalities in one and two variables; polynomial operations and graphing; linear, quadratic, exponential, and logarithmic functions with application and graphing; and formula manipulation. This course is designed to prepare students for college algebra or career opportunities.
Course Outcomes: 1. graph parabolas 2. solve linear inequalities 3. graph exponential functions 4. solve absolute value inequalities 5. graph linear equations 6. graph linear inequalities 7. perform binary function operations 8. classify relations 9. solve proportions 10. form inverse functions 11. solve exponential equations 12. manipulate formulas 13. graph logarithmic functions 14. use a graphing utility to analyze functions 15. solve logarithmic equations 16. classify quadratic solutions 17. evaluate functions

18. evaluate radical expressions 19. factor quadratic equations 20. solve linear equations 21. use logarithmic properties 22. form composite functions 23. solve linear applications 24. solve exponential applications 25. solve linear systems 26. solve logarithmic applications 27. use quadratic formula 28. use interval notation 29. use set-builder notation 30. perform binary polynomial operations 31. solve absolute value equations 32. participate in collaborative projects 33. find slope 34. recognize function graphs 35. write linear equations 36. find the greatest common factor 37. use internet resources 38. use written communication skills to express algebraic ideas 39. simplify radical expressions 40. use dimensional analysis 41. solve quadratic applications 42. solve systems of linear inequalities 43. use rules of exponents 44. simplify algebraic expressions
Implementation Cycle: Fall semester
Role in College Curriculum: (Check all that apply) ☒ General Education Core: Mathematics ☐ Technical Core (Specify Program) ☐ Restricted Elective (Specify Program) ☐ General Elective
Course Fee:
Instructor's Qualifications: Master's Degree plus 18 graduate level mathematics credits.
Expanded Course Description: In this course, the focus will be on problem solving skills and developing abilities to think mathematically. This course will prepare students for future math and science courses or job opportunities.

Appendix B:
Summary of Outcomes, Indicators, Performance Standards and Results

Course Level Assessment: Fall 2006 Intermediate Algebra – MTH 123				
Learning Outcome	Indicator	Percent of Correct Awarded Responses	Percent of Incorrect Responses	Performance Standard Met (80%)
Outcome 1: Graph parabolas	O14. Graph the parabola and label the coordinates of the vertex. Find the x-intercepts(s) and y-intercept, if they exist. $y = x^2 + 7x + 6$ O13. Graph the parabola and label the coordinates of the vertex. $y = -(x + 7)^2 + 4$	92%	8%	Yes
Outcome 2: Solve linear applications	10. A tool rental store charges a flat fee of \$6.50 to rent a chain saw and \$3.00 for each day, including the first. If you need to rent the saw and absolutely refuse to spend more than \$36.50, what's the maximum number of days you can keep the saw? 15. A new sports car, the Revolution, can be leased for \$3,000 down and \$300 per month, so that the cost of leasing is given by $y = 3000 + 300x$, where x is the length of the lease in months. The same dealership offers the Yachtsman, a luxury car, for \$5,000 down and \$260 per month. After how many months would the total cost of leasing the two cars be equal? 19. For over 20 years, the population of Tressel, Ohio has been increasing linearly according to the function $P(t) = 350t + 9,000$ where P is the number of residents, and t is years after 1980. Compute $P(0)$ and interpret its meaning in the context of this problem. 20. At one college, a study found that the average grade point average	88%	12%	Yes

	decreased linearly according to the function $g(h) = 3.00 - 0.15h$ where h is the number of hours per week spent watching reality shows on television. Compute $g(5)$ and interpret its meaning.			
Outcome 3: Use rules of exponents	O7. Simplify the expression by using the properties of rational exponents. Assume all variables represent positive real numbers. Express the final answer using positive exponents only.	60%	40%	No
Outcome 4: Solve systems of linear equations	11. Solve the system using the graphing method: $y = 3x + 5$, $2y - 6x = 8$ 12. Solve the system using the substitution method: $x = 4y + 16$, $2y + x = 10$ 13. Solve the system using the addition method: $x + 2y = 21$, $-4x + 8y = 28$	70%	30%	No