Course Assessment Report
Washtenaw Community College

Discipline	Course Number	Title
Mathematics	197	MTH 197 08/03/2017-Linear Algebra
Division	Department	Faculty Preparer
Math, Science and Engineering Tech	Mathematics	Lawrence David
Date of Last Filed Assessment Report		

I. Assessment Results per Student Learning Outcome

Outcome 1: Solve systems of linear equations with a parametric solution.

- Assessment Plan
  - Assessment Tool: Common departmental exam questions
  - Assessment Date: Fall 2012
  - Course section(s)/other population: all
  - Number students to be assessed: all students
  - How the assessment will be scored: rubric
  - Standard of success to be used for this assessment: 75% of students will score 75% or better
  - Who will score and analyze the data: departmental faculty

1. Indicate the Semester(s) and year(s) assessment data were collected for this report.

Fall (indicate years below)	Winter (indicate years below)	SP/SU (indicate years below)
2016, 2016, 2015	2016, 2017, 2015	2016, 2015

2. Provide assessment sample size data in the table below.

# of students enrolled	# of students assessed
387	246

3. If the number of students assessed differs from the number of students enrolled, please explain why all enrolled students were not assessed, e.g. absence, withdrawal, or did not complete activity.

Data was unavailable for some sections because some part-time instructors did not submit the data (final exams) for analysis. Also, some students did not complete the activity (final exam) so no data was collected from them.

4. Describe how students from all populations (day students on campus, DL, MM, evening, extension center sites, etc.) were included in the assessment based on your selection criteria.

All students from every section were included, except as described above.

5. Describe the process used to assess this outcome. Include a brief description of this tool and how it was scored.

Two common final exam questions were used to assess the outcome. In each question, students were given a system of linear equations and asked to find the solution to the system and write it in parametric form.

6. Briefly describe assessment results based on data collected for this outcome and tool during the course assessment. Discuss the extent to which students achieved this learning outcome and indicate whether the standard of success was met for this outcome and tool.

Met Standard of Success: Yes

92% of students across all sections analyzed scored 75% or better on these questions. This result far exceeds the goal of 75% considered a success according to the syllabus.

The outcomes for this class vary greatly in difficulty for students, and this outcome has relatively low difficulty. This probably explains in part why most students achieved this outcome.

7. Based on your interpretation of the assessment results, describe the areas of strength in student achievement of this learning outcome.

Students did very well on this outcome. The standard of success was 75% of students succeeding, and in this outcome had a 92% success rate.

A calculator is used to do the tedious calculations with a built-in matrix algebra function ("RREF" on the TI-84, which row reduces a matrix to reduced echelon form). Almost all students are able to learn how to row reduce a matrix using the calculator, which is the main computational task for this outcome.

Students tend to be strong in computational tasks, especially those that are algorithmic and aided by a calculator.

8. Based on your analysis of student performance, discuss the areas in which student achievement of this learning outcome could be improved. If student met standard of success, you may wish to identify your plans for continuous improvement.

The main room for improvement is interpreting the solution to a system, especially geometrically. However interpretation isn't currently part of the outcome, so we may want to consider adding an interpretation component to the outcome to make it more challenging and comprehensive. Based on the data, we are doing well in getting students to be able to succeed with the outcome as it is.

Outcome 2: Compute determinants and inverses of matrices.

- Assessment Plan
    - Assessment Tool: Common departmental exam questions
    - Assessment Date: Fall 2012
    - Course section(s)/other population: all
    - Number students to be assessed: all students
    - How the assessment will be scored: rubric
    - Standard of success to be used for this assessment: 75% of students will score 75% or better
    - Who will score and analyze the data: departmental faculty

1. Indicate the Semester(s) and year(s) assessment data were collected for this report.

Fall (indicate years below)	Winter (indicate years below)	SP/SU (indicate years below)
2016, 2016, 2015	2017, 2016, 2015	2016, 2015

2. Provide assessment sample size data in the table below.

# of students enrolled	# of students assessed
387	246

3. If the number of students assessed differs from the number of students enrolled, please explain why all enrolled students were not assessed, e.g. absence, withdrawal, or did not complete activity.

Data was unavailable for some sections because some part-time instructors did not submit the data (final exams) for analysis. Also, some students did not complete the activity (final exam) so no data was collected from them.

4. Describe how students from all populations (day students on campus, DL, MM, evening, extension center sites, etc.) were included in the assessment based on your selection criteria.

All students from every section were included, except as described above.

5. Describe the process used to assess this outcome. Include a brief description of this tool and how it was scored.

Three common final exam questions were used to assess the outcome. Students were asked (1) to calculate the determinant of a matrix by hand, (2) to find the inverse of the matrix, and (3) a qualitative question about the relationship between the value of the determinant and the invertibility of the matrix.

6. Briefly describe assessment results based on data collected for this outcome and tool during the course assessment. Discuss the extent to which students achieved this learning outcome and indicate whether the standard of success was met for this outcome and tool.

Met Standard of Success: Yes
98% of students across all sections analyzed scored 75% or better on these questions. This result far exceeds the goal of 75% considered a success according to the syllabus. The outcomes for this class vary greatly in difficulty for students, and this outcome has relatively low difficulty. This probably explains in part why most students achieved the outcome.

7. Based on your interpretation of the assessment results, describe the areas of strength in student achievement of this learning outcome.

Students did really well at this computational outcome. The standard of success was a 75% success rate, and they achieved a 98% success rate. Students were allowed to use a calculator to calculate the inverse, though they were required to calculate the determinant by hand. Usually they use a calculator to calculate determinants, but they still need to know how to do it by hand when necessary. So though they had to show the work to calculate the determinant by hand, they were able to use a calculator to check the final result. As with SLO 1, students tend to do well with computational tasks that are aided by a calculator.

8. Based on your analysis of student performance, discuss the areas in which student achievement of this learning outcome could be improved. If student met standard of success, you may wish to identify your plans for continuous improvement.

At 98% success there isn't much room for improvement for the outcome as written. We could consider rewriting it to make it more difficult and comprehensive, for example to include an interpretation component, in addition to the computation.

Outcome 3: Use the Gram-Schmidt algorithm to orthonormalize a set of vectors.

- Assessment Plan
    - Assessment Tool: Common departmental exam questions
    - Assessment Date: Fall 2012
    - Course section(s)/other population: all
    - Number students to be assessed: all students
    - How the assessment will be scored: rubric
    - Standard of success to be used for this assessment: 75% of students will score 75% or better
    - Who will score and analyze the data: departmental faculty

1. Indicate the Semester(s) and year(s) assessment data were collected for this report.

Fall (indicate years below)	Winter (indicate years below)	SP/SU (indicate years below)
2016, 2016, 2015	2017, 2016, 2015	2016, 2015

2. Provide assessment sample size data in the table below.

# of students enrolled	# of students assessed
387	246

3. If the number of students assessed differs from the number of students enrolled, please explain why all enrolled students were not assessed, e.g. absence, withdrawal, or did not complete activity.

Data was unavailable for some sections because some part-time instructors did not submit the data (final exams) for analysis. Also, some students did not complete the activity (final exam) so no data was collected from them.

4. Describe how students from all populations (day students on campus, DL, MM, evening, extension center sites, etc.) were included in the assessment based on your selection criteria.

All students from every section were included, except as described above.

5. Describe the process used to assess this outcome. Include a brief description of this tool and how it was scored.

A common final exam question was used to assess the outcome. Students were given a matrix and asked to find an orthonormal basis for the column space of the matrix. The main task required to do this is orthogonalizing the set of column vectors using the Gram-Schmidt algorithm.

6. Briefly describe assessment results based on data collected for this outcome and tool during the course assessment. Discuss the extent to which students achieved this learning outcome and indicate whether the standard of success was met for this outcome and tool.

Met Standard of Success: Yes
78% of students across all sections analyzed scored 75% or better on these questions. This result exceeds the goal of 75% considered a success according to the syllabus. This is probably the second most difficult outcome for most students, because it is difficult computationally, and also requires students to understand the abstract concept of an orthogonal set of vectors.

7. Based on your interpretation of the assessment results, describe the areas of strength in student achievement of this learning outcome.

At 78%, students just exceeded the standard of 75%. Students were good at using the algorithm, and following the formula.

8. Based on your analysis of student performance, discuss the areas in which student achievement of this learning outcome could be improved. If student met standard of success, you may wish to identify your plans for continuous improvement.

Students were not as good at consistency and detail. They were able to follow the algorithm and use the formula, but there are many steps in the algorithm, and opportunities to make mistakes. It also requires an understanding of the abstract context in order to see the big picture and know if the final answer makes sense. The main area of improvement is to better understand the abstract context of the algorithm. For example, what does "orthogonal" mean in reference to a set of vectors? How can you tell if a set is orthogonal or not? Why does the algorithm

produce an orthogonal set and how is the definition of an orthogonal set used to derive the algorithm? Understanding these abstract concepts should improve student success in the computational outcome.

Outcome 4: Apply the basic theory of subspaces and linear transformations.

- Assessment Plan
    - Assessment Tool: Common departmental exam questions
    - Assessment Date: Fall 2012
    - Course section(s)/other population: all
    - Number students to be assessed: all students
    - How the assessment will be scored: rubric
    - Standard of success to be used for this assessment: 75% of students will score 75% or better
    - Who will score and analyze the data: departmental faculty

1. Indicate the Semester(s) and year(s) assessment data were collected for this report.

Fall (indicate years below)	Winter (indicate years below)	SP/SU (indicate years below)
2016, 2016, 2015	2017, 2016, 2015	2016, 2015

2. Provide assessment sample size data in the table below.

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3. If the number of students assessed differs from the number of students enrolled, please explain why all enrolled students were not assessed, e.g. absence, withdrawal, or did not complete activity.

Data was unavailable for some sections because some part-time instructors did not submit the data (final exams) for analysis. Also, some students did not complete the activity (final exam) so no data was collected from them.

4. Describe how students from all populations (day students on campus, DL, MM, evening, extension center sites, etc.) were included in the assessment based on your selection criteria.

All students from every section were included, except as described above.

5. Describe the process used to assess this outcome. Include a brief description of this tool and how it was scored.

Two common final exam questions were used to assess the outcome. The first question asked if the set of all third degree polynomials of a certain form is a subspace of P4, and for an explanation of why or why not. The second question described a mapping from P2 to P2 and asked students to find the matrix for the transformation relative to the standard basis for P2.

6. Briefly describe assessment results based on data collected for this outcome and tool during the course assessment. Discuss the extent to which students achieved this learning outcome and indicate whether the standard of success was met for this outcome and tool.

Met Standard of Success: Yes

49% of students across all sections analyzed scored 75% or better on these questions. This result does not meet the goal of 75% considered a success according to the syllabus.

The outcomes for this class vary greatly in difficulty for students, and this outcome is by far the most difficult for almost all students. The main reason is probably because this outcome requires a solid understanding of several abstract concepts, and the types of questions that can be asked about these concepts often seem arbitrary and unrelated to a student who doesn't understand those underlying concepts. So while students will have seen at least a dozen different questions on homework and exams that are based on these concepts, they may not recognize them as related, and in particular may have the experience that these final exam questions are new, or "things we didn't learn in class".

7. Based on your interpretation of the assessment results, describe the areas of strength in student achievement of this learning outcome.

Most students demonstrated a basic understanding of at least some of the methods we use to determine if a subset is a subspace. For example, one method is to determine if the zero vector is in the subset. If it is not, then the subset is not a subspace. Most students demonstrated an understanding of this method, even if they weren't able to determine what the zero vector was in the given subset.

Likewise, many students were able to reproduce the formula for the matrix of a transformation relative to a basis, though they were often unable to apply the formula in the given context.

8. Based on your analysis of student performance, discuss the areas in which student achievement of this learning outcome could be improved. If student met standard of success, you may wish to identify your plans for continuous improvement.

This is the most difficult, most abstract outcome; and it is the most difficult probably because it is the most abstract. This course is usually students' first experience with abstract mathematics, which is a quantum step up in difficulty from computational math like calculus. Understanding the nature of abstract math in general, and the specific abstract concepts of this outcome, are the main areas of improvement. It's a paradigm shift where the answer to a question can be a paragraph or two of English, rather than a number. It's the difference between answering "why is this subset a subspace?" versus "what is the volume of this shape?" Realistically, the standard of 75% success may be high for this outcome in particular. As an instructor, if I get over 50% of my class to succeed with this outcome, I am thrilled. A student can master about half of this particular outcome and still get an A in the course, and be well prepared for the math courses that follow, where they will build upon and strengthen their understanding of abstract math. This is not to say that I think we should be satisfied with the 49% success rate from the current data. I think we should focus on this outcome in particular, and abstract math in general as we teach the course going forward.

Outcome 5: Compute eigenvalues and associated eigenvectors of linear transformations and use them to diagonalize matrices.

- Assessment Plan
    - Assessment Tool: Common departmental exam questions
    - Assessment Date: Fall 2012
    - Course section(s)/other population: all
    - Number students to be assessed: all students
    - How the assessment will be scored: rubric
    - Standard of success to be used for this assessment: 75% of students will score 75% or better
    - Who will score and analyze the data: departmental faculty

1. Indicate the Semester(s) and year(s) assessment data were collected for this report.

Fall (indicate years below)	Winter (indicate years below)	SP/SU (indicate years below)
2016, 2016, 2015	2017, 2016, 2015	2016, 2015

2. Provide assessment sample size data in the table below.

# of students enrolled	# of students assessed
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3. If the number of students assessed differs from the number of students enrolled, please explain why all enrolled students were not assessed, e.g. absence, withdrawal, or did not complete activity.

Data was unavailable for some sections because some part-time instructors did not submit the data (final exams) for analysis. Also, some students did not complete the activity (final exam) so no data was collected from them.

4. Describe how students from all populations (day students on campus, DL, MM, evening, extension center sites, etc.) were included in the assessment based on your selection criteria.

All students from every section were included, except as described above.

5. Describe the process used to assess this outcome. Include a brief description of this tool and how it was scored.

Two common final exam questions were used to assess the outcome. The first question had three parts. Students were given a square matrix and asked: (a) Find the eigenvalues of the matrix, (b) Find the eigenspace corresponding to each eigenvalue, and (c) diagonalize the matrix. The second question asked students to orthogonally diagonalize a symmetric matrix.

6. Briefly describe assessment results based on data collected for this outcome and tool during the course assessment. Discuss the extent to which students achieved this learning outcome and indicate whether the standard of success was met for this outcome and tool.

Met Standard of Success: Yes
89% of students across all sections analyzed scored 75% or better on these questions. This result exceeds the goal of 75% considered a success according to the syllabus.

7. Based on your interpretation of the assessment results, describe the areas of strength in student achievement of this learning outcome.

Students did well with the algorithm to find the eigenvalues and associated eigenvectors of a matrix. Many students demonstrated an understanding of the concepts of eigenvalues and eigenvectors.

8. Based on your analysis of student performance, discuss the areas in which student achievement of this learning outcome could be improved. If student met standard of success, you may wish to identify your plans for continuous improvement.

Students didn't do as well with finding orthogonally diagonalizing a symmetric matrix. This task requires not only finding eigenvalues and eigenvectors, but normalizing a set of vectors as well as constructing a matrix factorization that satisfies certain conditions. This is both computationally and conceptually more difficult than simply finding eigenvalues and associated eigenvectors. Since the outcome as written only covers this simpler task, students are actually performing better than the reported success rate would suggest, since the second problem included these more difficult tasks that are not part of the outcome.

As with the other successful outcomes, continuous improvement could include expanding the outcomes to include applications of eigenvalues and eigenvectors, like diagonalizing a matrix. We are effectively measuring such an expanded outcome already.

Outcome 6: Find a least square solutions to inconsistent systems of linear equations.

- Assessment Plan
    - Assessment Tool: Common departmental exam questions
    - Assessment Date: Fall 2012
    - Course section(s)/other population: all
    - Number students to be assessed: all students
    - How the assessment will be scored: rubric
    - Standard of success to be used for this assessment: 75% of students will score 75% or better
    - Who will score and analyze the data: departmental faculty

1. Indicate the Semester(s) and year(s) assessment data were collected for this report.

Fall (indicate years below)	Winter (indicate years below)	SP/SU (indicate years below)
2016, 2016, 2015	2016, 2015, 2017	2016, 2015

2. Provide assessment sample size data in the table below.

# of students enrolled	# of students assessed
387	246

3. If the number of students assessed differs from the number of students enrolled, please explain why all enrolled students were not assessed, e.g. absence, withdrawal, or did not complete activity.

Data was unavailable for some sections because some part-time instructors did not submit the data (final exams) for analysis. Also, some students did not complete the activity (final exam) so no data was collected from them.

4. Describe how students from all populations (day students on campus, DL, MM, evening, extension center sites, etc.) were included in the assessment based on your selection criteria.

All students from every section were included, except as described above.

5. Describe the process used to assess this outcome. Include a brief description of this tool and how it was scored.

A common final exam question was used to assess the outcome. The question presented students with an inconsistent system of equations and asked them to find the least squares solution. In this case, the solution set was infinite so the problem was more difficult than if there had been a unique solution.

6. Briefly describe assessment results based on data collected for this outcome and tool during the course assessment. Discuss the extent to which students achieved this learning outcome and indicate whether the standard of success was met for this outcome and tool.

Met Standard of Success: Yes

87% of students across all sections analyzed scored 75% or better on these questions. This result exceeds the goal of 75% considered a success according to the syllabus.

This is another difficult, but strictly speaking computational outcome.

7. Based on your interpretation of the assessment results, describe the areas of strength in student achievement of this learning outcome.

Students did well with the formula for finding the least squares solution to an inconsistent system. It requires multiple steps to implement, and some students made minor computational mistakes, but overall demonstrated competency in using the formula.

8. Based on your analysis of student performance, discuss the areas in which student achievement of this learning outcome could be improved. If student met standard of success, you may wish to identify your plans for continuous improvement.

As with the other outcomes, the biggest area of improvement is in understanding and applying the abstract concepts upon which the formula is based. The problem on the exam was one of the "harder ones" from the homework, so a lack of understanding of the concepts was revealed more than it would likely have been on an easier problem.

II. Course Summary and Action Plans Based on Assessment Results

1. Describe your overall impression of how this course is meeting the needs of students. Did the assessment process bring to light anything about student achievement of learning outcomes that surprised you?

This course primarily serves STEM students who want to transfer to a 4-year institution or are already enrolled at one and have chosen to take the course at WCC. That group is further broken down into math majors and non-math majors, particularly engineering and science majors. The course transfers to 4-year institutions as an introductory linear algebra course, also known as a computationally-based linear algebra course. Such courses are generally taken by non-math majors, though some math programs also require such a course. In that context, this course meets the needs of the target audience well. In fact, it goes above and beyond what is required of many introductory courses at 4-year schools. The syllabus is based directly on an equivalent course at the University of Michigan, in order to meet their requirements for the course to transfer. This is because the majority of our transfer students come from, or hope to transfer to, the U of M. Because the course is essentially the same as what is taught at U of M, a student who does well in our linear algebra course will be very well prepared compared to students who succeed at similar courses anywhere in the country. The one big surprise was the large difference in success levels between the more abstract outcomes and the more computational ones. I knew anecdotally that students did better on computational problems than abstract ones, but the data shows a very clear and wide gap in success rates.

2. Describe when and how this information, including the action plan, was or will be shared with Departmental Faculty.

This information, including the action plan, will be shared at a math department meeting once the report is complete.

3.

Intended Change(s)

Intended Change	Description of the change	Rationale	Implementation Date
Outcome Language	Some of the outcome language needs minor tweaks to be more accurate. Some outcomes will be expanded to include interpretation components and/or application components, pending department approval of those changes to the master syllabus.	The minor language tweaks will make the outcomes more specific and accurate. The additional components would be a part of continuous improvement, essentially raising the bar because we are greatly exceeding it with some of the outcomes as they are written.	2017

4. Is there anything that you would like to mention that was not already captured?

Context and Major Conclusions:

This course is unique in the math curriculum at WCC in that it includes a significant amount of abstract math. Traditionally, the first linear algebra course serves double duty as an introduction to the abstract math of upper level undergraduate courses, as well as teaching the content of the subject itself. This is usually a challenge for students, and they sometimes report feeling like the course is unnecessarily difficult since the computational parts of the course are "clouded" in abstract concepts. In later math courses, they discover that abstract concepts are the foundation of mathematics, and that the computational algorithms we derive from the concepts only exist because of them. The real power of math is in abstraction and generalization, which is why it is the universal language of science and engineering, and why so much math is required in those programs.

Instructors of this course therefore face a unique challenge in helping students with the paradigm shift from computational to abstract mathematics. Students often take on an identity of being "good at math" or "not good at math", and in K-12 and early college, "good at math" means being good at computational math. Abstract math is much more difficult, and students who struggle with it often get frustrated with the instructor or the course or both, since they "know"

they're good at math so if they're not succeeding in this one course, it must be the course and not them.

Personally I love this challenge, and the satisfaction of helping a student understand the nature of abstract math and succeed at doing it is incredibly rewarding. However, the relevant point is that the unique nature of this course is the context in which to interpret the assessment data.

The main conclusion I draw from the data is that student success follows very closely the computational and abstract natures of the outcomes. Students did much better on outcomes that were entirely computational, and not as well on outcomes that were very abstract.

It's appropriate for the outcomes to be what they are because they reflect the content of the subject matter of the syllabus, and that syllabus is fairly universal across undergraduate curricula nationwide. As such, the data is clear that the abstract parts of the course are where we can improve the most, and where we should focus our instructional efforts.

III. Attached Files

Data
Rubric

Faculty/Preparer:	Lawrence David	**Date:**	08/21/2017
Department Chair:	Lisa Rombes	**Date:**	08/21/2017
Dean:	Kristin Good	**Date:**	08/24/2017
Assessment Committee Chair:	Michelle Garey	**Date:**	10/30/2017

COURSE ASSESSMENT REPORT

I. Background Information

1. Course assessed:
   Course Discipline Code and Number: MTH 197
   Course Title: Linear Algebra
   Division/Department Codes: MNB / MTH

2. Semester assessment was conducted (check one):
   ☐ Fall 20__
   X Winter 2009
   ☐ Spring/Summer 20__

3. Assessment tool(s) used: check all that apply.
   ☐ Portfolio
   ☐ Standardized test
   ☐ Other external certification/licensure exam (specify):
   ☐ Survey
   ☐ Prompt
   ☐ Departmental exam
   ☐ Capstone experience (specify):
   X Other (specify): common exam questions.

4. Have these tools been used before?
   X Yes
   ☐ No

   If yes, have the tools been altered since its last administration? If so, briefly describe changes made.
   The course master syllabus was revised and updated in Fall 2008, some course contents and course objectives were changed to match what are covered in the current textbook.

5. Indicate the number of students assessed/total number of students enrolled in the course.
   42 students from both sections in Winter 2009 Semester participated in the assessment.

6. Describe how students were selected for the assessment.
   All students enrolled in both sections of Winter 2009 Semester.

II. Results

1. Briefly describe the changes that were implemented in the course as a result of the previous assessment.
   With the use of TI-calculators in teaching course subjects, we are able to put more time into the discussion of conceptual topics, helping students do more critical thinking. The calculator is useful in verifying conjecture and providing clues to help students understand more abstract topics of the course subjects, such as finding Null Space and Column Space of linear transformations, which eventually lead to the Rank Theorem.

2. List each outcome that was assessed for this report exactly as it is stated on the course master syllabus.
   [1] Outcome 1: Solve systems of linear equations. [2] Outcome 2: Compute determinants. [3] Outcome 4: Apply the basic theory of subspaces and linear transformations. [4] Outcome 6: Compute the eigenvalues and associated eigenvectors of linear transformations. [5] Outcome 7: Finding least square solutions to inconsistent systems of linear equations. ***Please see the attached copy of assessment problems and remarks about how & why these problems were selected.***

3. Briefly describe assessment results based on data collected during the course assessment, demonstrating the extent to which students are achieving each of the learning outcomes listed above. ***Please attach a summary of the data collected.***
   The assessment problems were carefully selected to reflect the different aspects of the course subjects, some problems checked the algebra skills (such as problems [1](a), [3], [4]), some problems checked the ability of performing critical thinking, using some basic concepts discussed in the related topics (such as problems [1](b) and [2]). Each problem was graded on a 20-point basis, with the total of 5 problems equal to 100 points. For each student, scores of each problem was listed, we would look at each student's total score (to understand their

average performance) and also compare the scores of each problem separately, to find out the strengths and weaknesses of the students' learning. ***Please see the attached summary of assessment scores collected.***

4. For each outcome assessed, indicate the standard of success used, and the percentage of students who achieved that level of success. ***Please attach the rubric/scoring guide used for the assessment.***
   We would analyze the scores of all students who received a grade of C or better. For each problem, a score of 14 or above is considered successful (this is the equivalent of 70 points on a 100-point basis). Below we listed the percentage of students (with a grade of C or better) who are successful for each problem.
   - ▶ For problem [1], 28 out of 32, or 87.5%
   - ▶ For problem [2], 30 out of 32, or 93.75%
   - ▶ For problem [3], 31 out of 32, or 96.88%
   - ▶ For problem [4], 21 out of 32, or 65.63%
   - ▶ For problem [5], 28 out of 32, or 87.5%

   Overall, 29 out of 32 students who got a C or better passed the assessment with 70% or higher.

5. Describe the areas of strength and weakness in students' achievement of the learning outcomes shown in assessment results.
   Strengths: Able to use a calculator to find the solutions of basic types questions, such as using the method of row reduction to solve a system of linear equations, evaluate determinant, etc.

   Weaknesses: May have trouble solving problems where the answers can not be completely determined with a calculator, and where some algebra skills & concepts may be needed. This is shown by the results of problem [4].

III. Changes influenced by assessment results

1. If weaknesses were found (see above) or students did not meet expectations, describe the action that will be taken to address these weaknesses.

   Put more emphasis on the discussion of critical thinking topics, showing students how to resolve problems where a combination of algebra skills and calculator would be required. Students need to understand that calculator is a good tool, but it can not think, they need to learn how to think or reason to resolve problems.

2. Identify intended changes that will be instituted based on results of this assessment activity (check all that apply). Please describe changes and give rationale for change.
   a. ☐ Outcomes/Assessments on the Master Syllabus
      Change/rationale:

   b. ☐ Objectives/Evaluation on the Master Syllabus
      Change/rationale:

   c. ☐ Course pre-requisites on the Master Syllabus
      Change/rationale:

   d. ☐ 1st Day Handouts
      Change/rationale:

   e. ☒ Course assignments
      Change/rationale: Emphasize more on assignments requiring critical thinking. Students need to understand that ***calculator is a good tool, but it cannot resolve all the problems***. They need to figure out the best way to resolve the problems

f. ☐ Course materials (check all that apply)
- ☐ Textbook
- ☐ Handouts
- ☒ Other: Upgrade the model of calculators. The current calculator model (TI-83+) required for the course has limited capability on performing vector operations, such as finding eigenvalues and eigenvectors. Some students really have problems with learning these concepts & topics, as is shown by the results of problem [4]. A better ***equipped*** calculator would smooth out this learning process.

g. ☐ Instructional methods
Change/rationale:

h. ☐ Individual lessons & activities
Change/rationale:

3. What is the timeline for implementing these actions? Over the next several semesters, beginning Fall 2009.

IV. Future plans

1. Describe the extent to which the assessment tools used were effective in measuring student achievement of learning outcomes for this course.

   Given the fact that, out of the 32 students who successfully completed the course, 29 of them passed the assessment, we can conclude that the assessment tools used so far are effective for this course.

2. If the assessment tools were not effective, describe the changes that will be made for future assessments.

3. Which outcomes from the master syllabus have been addressed in this report?
   All _____ Selected __√__
   If "All", provide the report date for the next full review: _____.
   If "Selected", provide the report date for remaining outcomes: Fall 2011.

Submitted by:

Print: Yin Lu (Faculty/Preparer) **Signature** Yin Lu **Date:** 8-13-2009

Print: Kristin Chatas (Department Chair) **Signature** [signature] **Date:** 8-18-2009

Print: Martha A. Showalter (Dean/Administrator) **Signature** [signature] **Date:** AUG 20 2009

logged 8/25/09 s/l