

County College of Morris

ACADEMIC OUTCOMES ASSESSMENT SUMMARY FORM

Please complete a separate form for each department and each program. Summary forms are due each year on June 15. Completed forms should be submitted electronically to dsmith2@ccm.edu and to your division.

ACADEMIC YEAR: 2016

DEPARTMENT: Mathematics

PROGRAM: Mathematics

SUBMITTED BY: Chairperson, Alexis Thurman and Assistant Professor, Kelly Fitzpatrick

PERSON RESPONSIBLE FOR ASSESSMENT: Assistant Professor, Kelly Fitzpatrick

PART ONE

What was our plan? Describe the department/program assessment plan you employed over the past year.

- ♦ **Identify and list the learning outcomes that were assessed.**
 - ♦ Q1- Solving rational linear equations
 - ♦ Q2- Solving applications involving percentages
 - ♦ Q3- Squaring binomials
 - ♦ Q4- Solving quadratic equations
 - ♦ Q5- Solving geometric applications
 - ♦ Q6- Graphing and interpreting linear equations
- ♦ **How were these outcomes assessed?**
 - ♦ Describe your department's assessment process including courses where the assessment occurs, a description of the assessment instrument, and identification of the instrument by type(s) as listed in 1 – 8 above.

The mathematics department administers an internally developed assessment test during the 13th and 14th week of the spring and fall 2016 semester. The test is comprised of six multiple choice questions. Historical Analysis is performed on our gateway classes, MAT110 College Algebra and MAT 131 Calculus.

	# of Students	# of Classes	# of Sections
Spring 2016	896	7	58
Fall 2016	1104	7	69

The results from the test are provided, and two main statistics are highlighted. The first analysis focuses on the percentage of correct responses. The second highlights the most frequent incorrect response as well as the percentage of students who chose that response.

The courses are listed below.

Credits	Course Number	Course title
NC	016	Intermediate Algebra
4- CR	120	Mathematics for the Liberal Arts
3- CR	117	Math for Business and Economics (only in the Fall)
3- CR	110	College Algebra
3- CR	118	Calculus with application to Business and Economics
4- CR	123	Pre-calculus
4- CR	113	Applied Calculus (for Engineering)
4- CR	131	Analytical Geometry and Calculus I

- ♦ **For each of the methods you've employed, include an Expected Level of Achievement (ELA)—what you regard to be an acceptable standard for students to meet.**

For the non-credited classes, the benchmark for performance for each question was set at a 60% correct response rate. For the credited math classes, the benchmark was raised to 70% and this semester we raised the benchmark for calculus based classes to 80%. The table below provides the results for the classes and the number of questions where the correct response was above the benchmarks set. For further information, historical trends and comments please reference the formal report.

	Spring 2015	Fall 2015	Spring 2016	Fall 2016
Non Credit Classes	# above 60%	# above 60%	# above 60%	# above 60%
MAT 016	3/6	3/6	4/6	3/6

Credit Classes	# above 70%	# above 70%	# above 70%	# above 70%
MAT 120	0/6	0/6	0/6	1/6
MAT 117	Not offered	1/6	Not offered	5/6
MAT 110	4/6	4/6	4/6	4/6
Credit Classes	# above 80%	# above 80%	# above 80%	# above 80%
MAT 118	4/6	4/6	6/6	
MAT 123	4/6	4/6	5/6	5/6
MAT 113	5/6	3/6	3/6	3/6
MAT 131	3/6	6/6	4/6	6/6

- ♦ **When were these outcomes assessed?**

The mathematics department administers an internally developed assessment test during the 13th and 14th week of the spring and fall semester.

County College of Morris

ACADEMIC OUTCOMES ASSESSMENT SUMMARY FORM

Page 2

ACADEMIC YEAR:2016

DEPARTMENT: Mathematics

PROGRAM: Mathematics

PART TWO

What were this year's results? Present and reflect on the outcomes of implementing the assessment plan detailed in PART ONE above.

- ♦ What are the results of your outcomes assessment process this year? Please include all data collected.
- ♦ See the formal report for further comments and analysis.

% answered correct- Spring 2016									
Class	Q1	Q2	Q3	Q4	Q5	Q6	n-# students	Average	Weight
016	53%	67%	63%	61%	41%	66%	309	58%	100%
120	46%	38%	44%	31%	14%	61%	37	39%	6%
110	62%	70%	85%	73%	58%	73%	304	70%	52%
123	80%	82%	95%	86%	72%	87%	133	84%	23%
131	93%	76%	95%	93%	73%	89%	80	86%	14%
117									
118	80%	80%	80%	80%	80%	90%	10	82%	2%
113	74%	78%	96%	74%	96%	96%	23	86%	4%
Weighted Average-Credit	70%	72%	86%	76%	62%	79%	587	74%	

% answered correct- Fall 2016									
Class	Q1	Q2	Q3	Q4	Q5	Q6	n-# students	Average	Weight
016	49%	63%	64%	59%	40%	70%	336	57%	100%
120	43%	65%	37%	44%	42%	73%	182	51%	24%
110	69%	75%	81%	74%	60%	79%	352	73%	46%
123	81%	84%	90%	86%	74%	89%	114	84%	15%
131	87%	84%	94%	91%	80%	86%	85	87%	11%
117	70%	87%	70%	74%	61%	91%	23	75%	3%
118									
113	92%	83%	75%	75%	33%	83%	12	74%	2%
11688%	67%	75%	73%	71%	60%	80%	768	71%	

Worst Performance in the class

Best Performance >70%

- ♦ **What are the results of your outcomes assessment process this year? Please include all data collected.**

Most Frequent Incorrect Response-Spring 2016

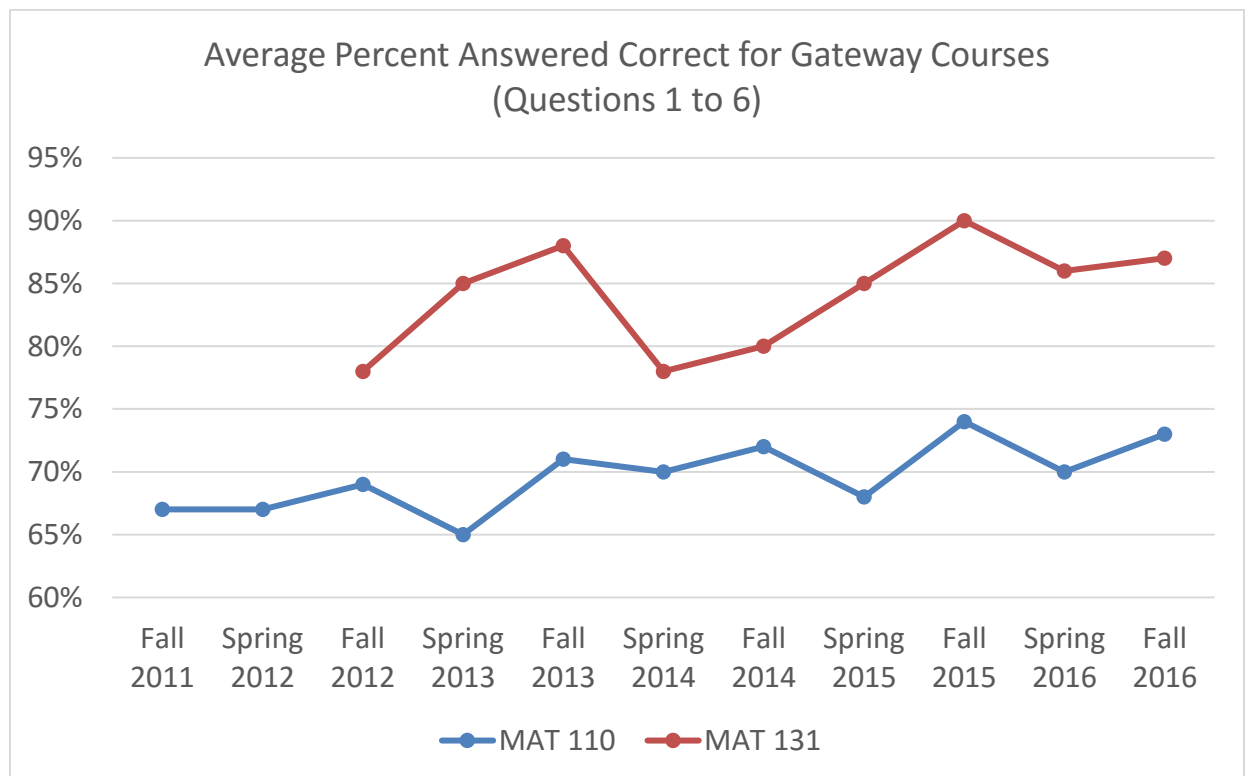
Class	Q1	Q2	Q3	Q4	Q5	Q6	n-# students	# sections
016	23% D	26% A	14% A	14% A/E	27% E	13% D	309	23
120	32% D	32% B	22% A	39% C	34% E	18% B	37	2
110	19% D	21% A	6% B	14% A	24% E	11% D	304	18
123	13% D	15% A	3% B	10% A	17% E	5% D	133	8
131	5%E	18% A	4% B	6% A	16% E	8% D	80	5
117								
118	10% D/E	10% A/E	20% B	10% A/E	20% D	10% A	10	1
113	22% D	22% A	4% E	13% E	4% E	4%A	23	1
Total							896	58

Most Frequent Incorrect Response-Fall 2016

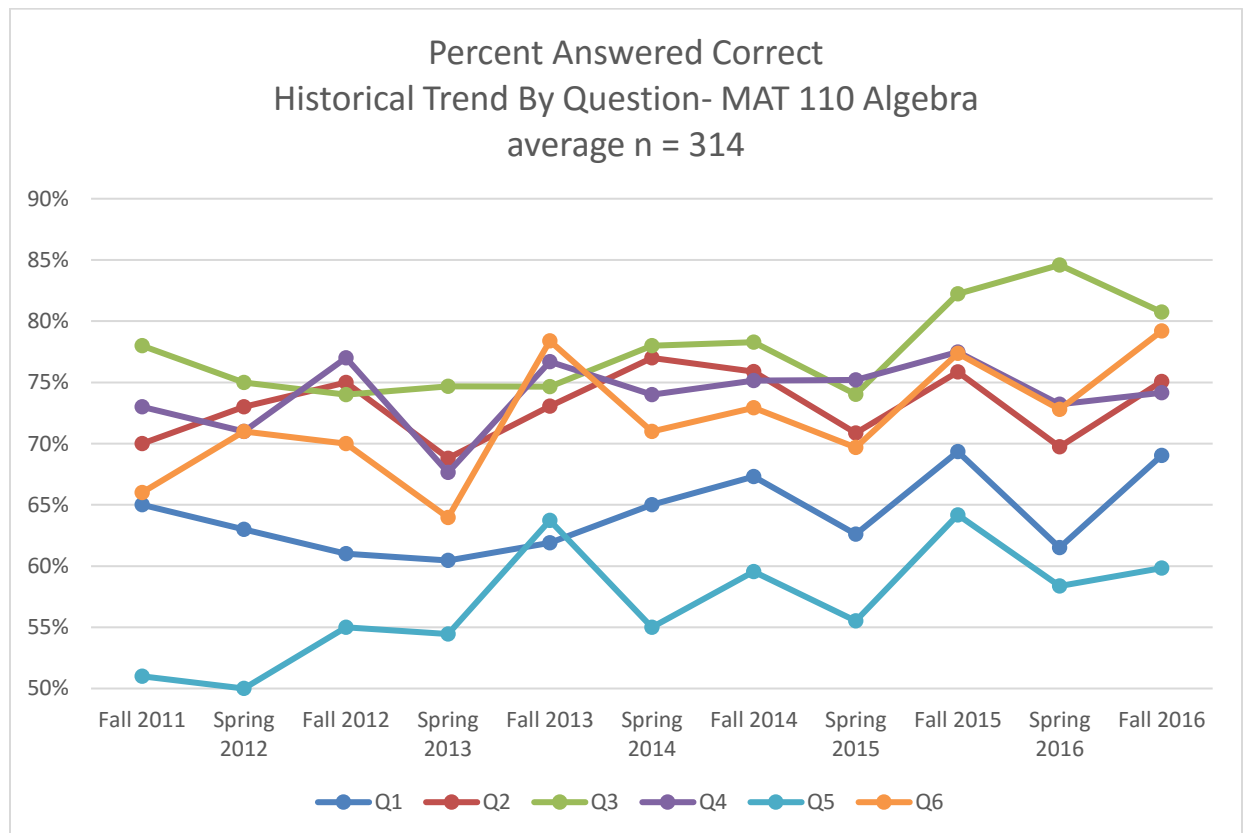
[illegible]

- ♦ **Evaluate and reflect on the results. Are they favorable? Disappointing? About what was expected? If the results did not meet the ELA (Expected Level of Achievement), provide an action plan that includes revisions to and/or further development of your assessment plan.**

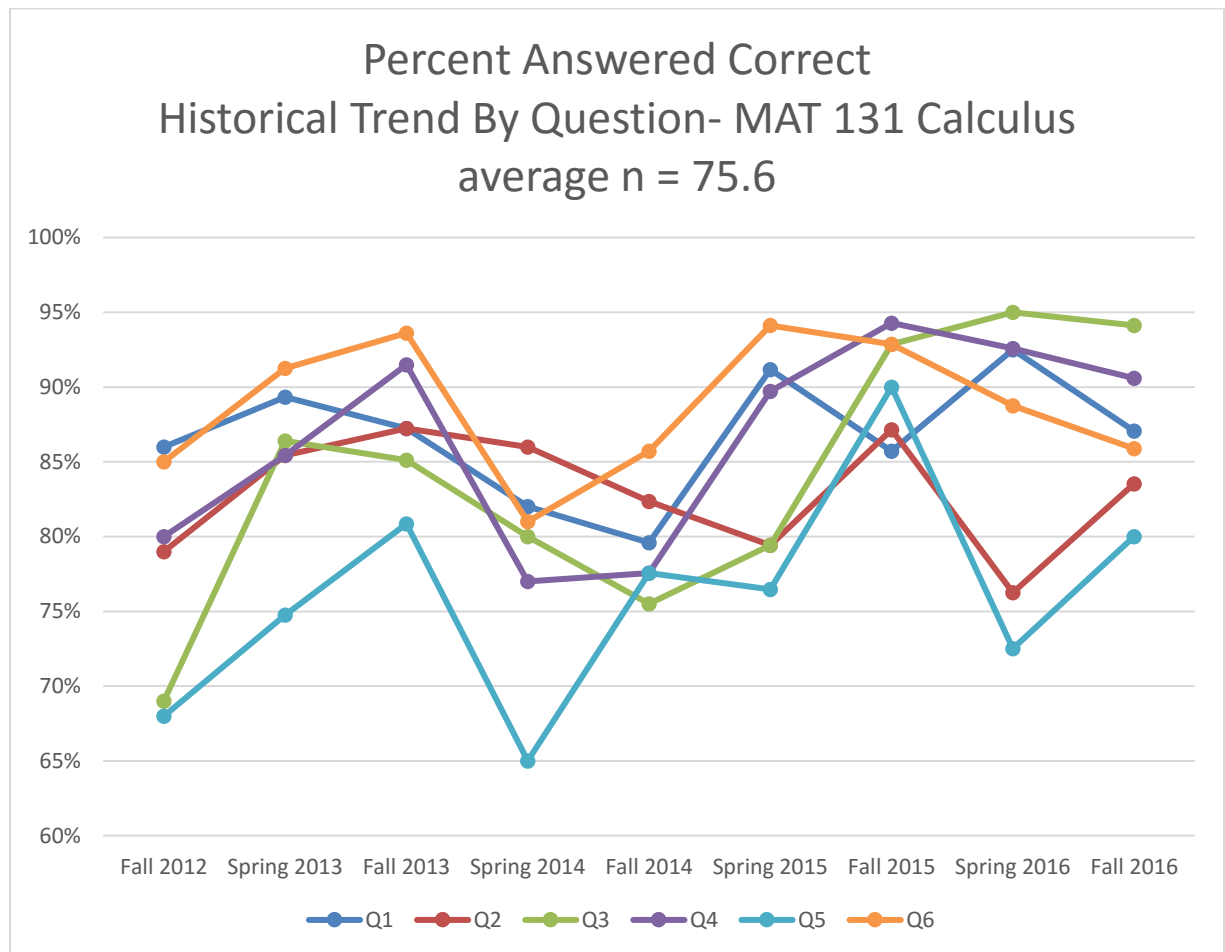
The chart below depicts what the mathematics department expects to see in the difference between the performance in MAT 110 College Algebra vs MAT 131 Calculus. MAT 131 maintains a 10 to 20 point spread above the performance of MAT 110. This is what we expect to see.



The chart below is for our gateway course, MAT 110- College Algebra. We can see that questions 1 and 5 underperform questions 2,3,4 and 6. Our focus will be to continue to support students in the areas of percentage and word problems. Questions 2,3,4 and 6 are generally above the 70% benchmark.



The chart below is for our gateway course, MAT 131. The graph is of the percent answered correct by question from Fall 2012 to Fall 2016. We can see that question 5 generally underperforms the rest of the questions. **Generally speaking, all 6 questions are usually above the new 80% benchmark for MAT 131.**



For information and more details about the exam and the test questions please reference the formal report.

♦ **How are results shared within department and/or with students?**

The results were discussed at our departmental meetings at which time the reports were also distributed. The department meeting was held on March 28, 2017. The students do not see the results of the report.

ACADEMIC YEAR: 2016

DEPARTMENT: Mathematics

PROGRAM: Mathematics

PART THREE

How can we use the results? Reflect on the changes in curriculum based on assessment, and on future goals.

- ♦ **Summarize what changes in curriculum and teaching have resulted and will result from your assessments, especially where results were surprising. Describe how data has been used in making these changes.**

There will be no current changes to the curriculum based on this year's assessment.

- ♦ **Share any plans the department/program has for future assessment.**

The department will continue to monitor the progress of MAT 120 since this course is still new to our assessment program.

The department is also actively monitoring the progress in MAT 016, with MAT 007 being the new prerequisite to the course. There is a more detailed analysis of MAT 016 in the formal report this year, the department is tracing the success rates in the course alongside the results from the assessment exam.

County College of Morris
Mathematics Department
Outcome Assessment
2016 Yearly Report

Prepared by:

Kelly Fitzpatrick-Assistant Professor of Mathematics

Executive Summary:

The mathematics department at the County College of Morris values the primary strategic goal of the college to emphasize student success. Through the biannual assessment process the mathematics department is able to identify trends in progress and make adjustments to our curriculum and teaching methods. The exam is administered twice a calendar year; once in late April in the spring semester then again in early November for the fall semester. The assessment exam is a six question multiple choice exam. We administer the same exam across all different levels, which allows the department to determine if students have mastered the learning outcomes. Upon completion of MAT 131 Calculus it is evident in our analysis that students have mastered these learning outcomes.

The report highlights the percent correct response rate and the historical progression. The report also highlights the most incorrect response rate. The assessment report allows the department to reflect on areas of strength and areas of weakness. Generally speaking, we have been able to see an improvement in the success of our students as they progress to higher level math courses. MAT 131 calculus has remained the most successful course in our analysis.

Benchmark analysis is used to track the performance on the top level and determine if classes are showing improvement or weakness from semester to semester. For non-credit classes the benchmark is set to 60% correct response rate and for credited courses we set the benchmark to 70% correct response rate. This semester we have increased the benchmark for calculus based credit courses to 80% to better reflect the ability of the student.

Since the inception of our new remedial course MAT 007 on Spring 2015, this course has become the new prerequisite to MAT 016. The department of mathematics has not seen a change in the assessment performance of MAT 016. This could be because the assessment exam is administered at the end of the semester and not at the start of the semester, so students show mastery of these concepts as a result of completing the course. There is a special section on the analysis of MAT 016 included in this year's report.

Procedure:

The mathematics department administered an assessment test during the 13th and 14th week of the spring and fall 2016 semester. The test is comprised of six multiple choice questions.

	# of Students	# of Classes	# of Sections
Spring 2016	896	7	58
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The courses are listed below.

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4- CR	120	Mathematics for the Liberal Arts
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3- CR	110	College Algebra
3- CR	118	Calculus with application to Business and Economics (Spring Only)
4- CR	123	Pre-calculus
4- CR	113	Applied Calculus (for Engineering)
4- CR	131	Analytical Geometry and Calculus I

The assessment test focuses on the following six areas of mathematics:

- Q1- Solving rational linear equations
- Q2- Solving applications involving percentages
- Q3- Squaring binomials
- Q4- Solving quadratic equations
- Q5- Solving geometric applications
- Q6- Graphing and interpreting linear equations

The results from the test are provided, and two main statistics are highlighted. The first analysis focuses on the percentage of correct responses. The second highlights the most frequent incorrect response as well as the percentage of students who chose that response.

Percent of Correct Responses - Highlights

The data was analyzed into two separate categories- the non-credit classes (Math 016) and the credited classes (Math 110, 120, 123, 131, 117(Fall only), 118, 113). In 2015, only MAT 016 for non-credit classes was analyzed and MAT 120 was added to the list of credited classes this same year. The weighted average was calculated; then the results were compared against each other. The weights were based on class size to more accurately reflect the student's results.

Overall Percent Correct	Spring 2013	Fall 2013	Spring 2014	Fall 2014	Spring 2015	Fall 2015	Spring 2016	Fall 2016
Weighted Average- Non-Credit	47%	51%	48%	53%	57%	57%	58%	57%
Weighted Average- Credit Class	72%	74%	74%	74%	72%	73%	74%	71%

Overview:

For the non-credited classes, the benchmark for performance for each question was set at a 60% correct response rate. For the credited math classes (MAT 120, 117, 110), the benchmark is set to 70%. This year the department of mathematics raised the benchmark for MAT 118, 123, 113 and 131 to 80%. This new benchmark will better reflect the capabilities of the student's ability to master the material. This increased benchmark will also better allow the department to track historical trends. We can now clearly see that for MAT 131 Fall 2015 and Fall 2016 have all six questions above the 80% benchmark for percent answered correctly, this is showcasing the improvement in students during the Fall semester. The table below provides the historical results for the classes and the number of questions where the correct response was above the benchmarks set.

There was an increase in the number of questions above 60% for MAT 016 in 2015 and 2016 from the historical rate of 2/6 now this class is achieving 3/6 and 4/6. I would attribute this success to the use of MyMathLab in all MAT016 classes and standardizing the homework for this course. MyMathLab provides many useful features designed to enhance student's success. MyMathLab features that assist students include; help me solve this, view an example, e-text book, video reinforcement and a direct e-mail link to ask my instructor. This has enhanced our student's success in understanding core learning outcomes.

For the credited math classes, the results seemed to be in line with the historical trend. This was the second year we analyzed MAT 120, Math for Liberal Arts, the performance was below expectations for a credited math class although there was an improvement in question number 6 the interpretation of a line, this question scored a 73% correct response and was 12% above last semester. There was also a much better sample as 182 students completed the assessment for MAT 120 in the Fall, as opposed to only 37 students completing the assessment in the Spring 2016 semester. **The overall average for MAT 120 also showed a huge improvement, Spring 2016 the average was 39% and in Fall 2016 the average jumped to 51%.**

	Spring 2015	Fall 2015	Spring 2016	Fall 2016
Non Credit Classes	# above 60%	# above 60%	# above 60%	# above 60%
MAT 016	3/6	3/6	4/6	3/6

Credit Classes	# above 70%	# above 70%	# above 70%	# above 70%
MAT 120	0/6	0/6	0/6	1/6
MAT 117	Not offered	1/6	Not offered	5/6
MAT 110	4/6	4/6	4/6	4/6
Credit Classes	# above 80%	# above 80%	# above 80%	# above 80%
MAT 118	4/6	4/6	6/6	
MAT 123	4/6	4/6	5/6	5/6
MAT 113	5/6	3/6	3/6	3/6
MAT 131	3/6	6/6	4/6	6/6

% answered correct- Spring 2016
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Class	Q1	Q2	Q3	Q4	Q5	Q6	n-# students	Average	Weight
016	53%	67%	63%	61%	41%	66%	309	58%	100%
120	46%	38%	44%	31%	14%	61%	37	39%	6%
110	62%	70%	85%	73%	58%	73%	304	70%	52%
123	80%	82%	95%	86%	72%	87%	133	84%	23%
131	93%	76%	95%	93%	73%	89%	80	86%	14%
117									
118	80%	80%	80%	80%	80%	90%	10	82%	2%
113	74%	78%	96%	74%	96%	96%	23	86%	4%
Weighted Average-Credit	70%	72%	86%	76%	62%	79%	587	74%	

% answered correct- Fall 2016

Class	Q1	Q2	Q3	Q4	Q5	Q6	n-# students	Average	Weight
016	49%	63%	64%	59%	40%	70%	336	57%	100%
120	43%	65%	37%	44%	42%	73%	182	51%	24%
110	69%	75%	81%	74%	60%	79%	352	73%	46%
123	81%	84%	90%	86%	74%	89%	114	84%	15%
131	87%	84%	94%	91%	80%	86%	85	87%	11%
117	70%	87%	70%	74%	61%	91%	23	75%	3%
118									
113	92%	83%	75%	75%	33%	83%	12	74%	2%
11688%	67%	75%	73%	71%	60%	80%	768	71%	

Worst Performance in the class
Best Performance >70%

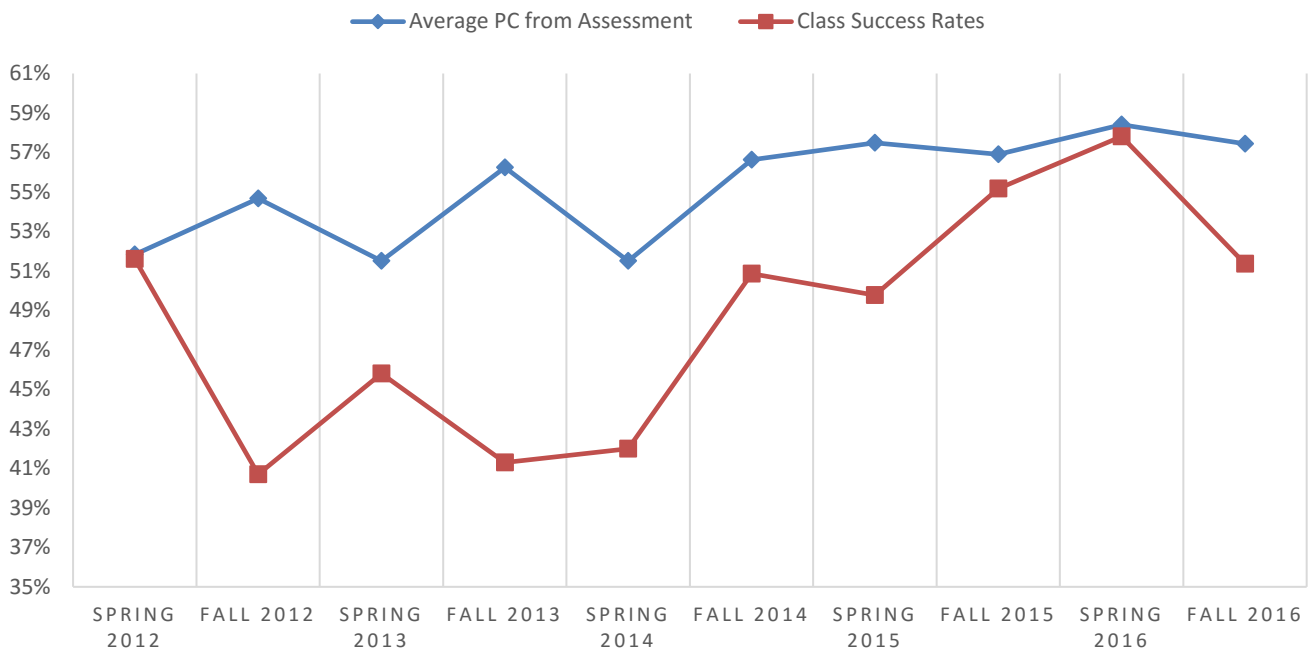
Analysis of MAT 016 Intermediate Algebra

The analysis below is for MAT 016 Intermediate Algebra and shows that since the inception of standardizing the homework (Spring 2015) in MyMathLab across all sections we have seen an improvement in both the results of the assessment report and the success rates in the course. This showcases that the Department of Mathematics continues to align their goals with the strategic goals of the college; to improve student success.

Term	Q1	Q2	Q3	Q4	Q5	Q6	n	Average PC from Assessment	Class Success Rates
Fall 2011	43%	56%	58%	50%	44%	63%	312	52%	
Spring 2012	44%	62%	57%	52%	38%	58%	281	52%	51.60%
Fall 2012	47%	67%	61%	51%	42%	60%	172	55%	40.70%
Spring 2013	35%	63%	52%	51%	43%	66%	304	52%	45.80%
Fall 2013	44%	64%	64%	60%	41%	64%	209	56%	41.30%
Spring 2014	47%	60%	50%	53%	38%	61%	237	52%	42.00%
Fall 2014	55%	61%	59%	57%	44%	64%	218	57%	50.86%
Spring 2015	50%	63%	65%	59%	46%	62%	349	57%	49.78%
Fall 2015	53%	60%	65%	54%	41%	69%	247	57%	55.17%
Spring 2016	53%	67%	63%	61%	41%	66%	309	58%	57.81%
Fall 2016	49%	63%	64%	59%	40%	70%	336	57%	51.36%

	Q1	Q2	Q3	Q4	Q5	Q6	n	Average	Class Success Rates
Average before Spring 2015	45%	62%	57%	53%	42%	62%	248	54%	45%
Average After Spring 2015 (inclusive)	51%	63%	64%	58%	42%	67%	310	58%	54%
Difference-positive numbers are improvements	6%	1%	7%	5%	1%	5%		4%	8%

COMPARISON OF ASSESSMENT RESULTS AND CLASS SUCCESS RATES FOR MAT 016



Percent of Correct Responses - Recommended Improvements

Question #5, the perimeter word problem, asks students to translate from a sentence to an algebraic expression and then solve for a variable. This has been and continues to be a difficult question for the non-credit courses and lower level credited courses. The results are evident in the following charts and highlighted in yellow.

Question #5 % Correct Results	Spring 2013	Fall 2013	Spring 2014	Fall 2014	Spring 2015	Fall 2015	Spring 2016	Fall 2016
Weighted Average Non Credit	37%	41%	36%	37%	46%	41%	41%	40%
Weighted Average Credit	62%	66%	61%	63%	60%	64%	62%	60%

Most Frequent Incorrect Response Recommendations

Q1- The correct answer was $\frac{2}{15}$. The most frequent incorrect response was “D” the reciprocal $\frac{15}{2}$. Students need to be encouraged to work with equations that contain fractions and practice checking their solutions.

Q2- The correct answer was 180. The most frequent incorrect response was “A”, 76.05 the result of multiplying when the student should have divided.

Q3- The correct answer was $25x^2 - 20x + 4$. One of the most frequent incorrect responses was $25x^2 - 4$, a mistake in not recognizing there should be a middle term. Another frequent incorrect response was $25x^2 - 20x - 4$, a mistake in the sign of the last term resulting from the multiplication of two negative numbers. Professors are encouraged to reinforce that a negative number multiplied by a negative number is a positive number. Professors are also encouraged to reinforce the importance of the parentheses in the original problem and explain that $(5x - 2)^2 \neq (5x)^2 - (2)^2$. This will illustrate to students how simply changing the placement of the parentheses will have a direct impact on changing the results of the final answer.

Q4(updated)- The correct answer was 7 or -4. The most frequent incorrect response was generally A, the mistake of mixing up the signs or maybe not working all the way through the problem using the zero factor property to solve for x. Students struggle with recognizing incorrect answers and are encouraged to check that their final answer is correct. When this question is in the form of a multiple choice question the problem can also be viewed as an evaluation question. Students should be comfortable plugging in the answers given to verify which one is correct and checking their solutions.

Q5- The correct answer was $w = 30$ feet. The most frequent incorrect response was “E”, none of the above. Students need the most assistance in the area of translating sentences into algebraic expressions. Students may also be swayed to the response of “E- None of the above” for psychological reasons.

Q6- The correct answer was $y = 2x - 4$. The most frequent incorrect response was mixed. Students struggle with getting both the slope and y intercept correct and distinguishing the difference between the two.

Above 30% Incorrect Response Rate (Highlighted in Red)

Highlighted in red in the below tables are the incorrect response rates above 30%. This type of pooling the incorrect response indicates an area of weakness for the students.

Most Frequent Incorrect Response-Spring 2016

Class	Q1	Q2	Q3	Q4	Q5	Q6	n-# students	# sections
016	23% D	26% A	14% A	14% A/E	27% E	13% D	309	23
120	32% D	32% B	22% A	39% C	34% E	18% B	37	2
110	19% D	21% A	6% B	14% A	24% E	11% D	304	18
123	13% D	15% A	3% B	10% A	17% E	5% D	133	8
131	5%E	18% A	4% B	6% A	16% E	8% D	80	5
117								
118	10% D/E	10% A/E	20% B	10% A/E	20% D	10% A	10	1
113	22% D	22% A	4% E	13% E	4% E	4%A	23	1
Total							896	58

Most Frequent Incorrect Response-Fall 2016

Class	Q1	Q2	Q3	Q4	Q5	Q6	n-# students	# sections
016	28% D	29% A	14% B	15% A	26% E	12% D	336	25
120	25% D	18% A	34% A	27% E	25% E	8% A/B	182	10
110	15% D	20% A	9% B	14% A	21% E	10% D	352	19
123	12% D	11% A	7% B	11% A	16% E	5% D	114	8
131	6%D	9% A	4% B	4% A	11% E	8% D	85	5
117	17% E	9% A	17% A	13% A	30% E	4% A/D	23	1
118								
113	8% D	17% A	17% A	17% E	42% E	17%D	12	1
Total							1,104	69

The exam administered between the two periods was the same.

The actual exam can be provided for review.

