CPAS 2014-15 Mathematics
Note: All Course SLOs have been mapped to Program SLOs.

Fall 2014
Group A Assess

Course	**Program Outcome:** *Build competencies in basic mathematical skills to help students achieve their academic Goals.*
021	Assessment revisions discussed and approved at Fall 2014 SLOs retreat
122	Assessment revisions discussed and approved at Fall 2014 SLOs retreat
123	Assessment revisions discussed and approved at Fall 2014 SLOs retreat
	Program Outcome: *Prepare students to earn an AA/AS Degree*
126A	Assessment revisions discussed and approved at Fall 2014 SLOs retreat
126B	Assessment revisions discussed and approved at Fall 2014 SLOs retreat
127	Assessment revisions discussed and approved at Fall 2014 SLOs retreat
128	New assessment tool discussed and approved at Fall 2014 SLOs retreat

Group B Revise and Implement

Course	Action
	Program Outcome: *Prepare students to transfer to a four-year institution.*
229/231	Revision and Implementation Stages
230	Revision and Implementation Stages
232	Revision and Implementation Stages
242	Revision and Implementation Stages

Group C Revise and Implement

Course	Action
	Program Outcome: *Prepare students to transfer to a four-year institution.*
255	Revision and Implementation Stages
265A	Revision and Implementation Stages
265B	Revision and Implementation Stages
	Program Outcome: *Prepare student for math A.S. and/or A.S.-T. Degree*
283	Revision and Implementation Stages
287	Revision and Implementation Stages

Group D Analyze

Course	Action
	Program Outcome: *Build competencies in basic mathematical skills to help students achieve their academic Goals.*
003	Data Analyzed and discussed at the Fall 2014 SLOs retreat. **Summary Analysis:** We did a comparison between the Spring 2012 assessment and the Spring 2014 assessment. Students did well overall both years but performed poorly on the order of operations problems (#8 and #9). In fact, all of the results from Spring 2014 are comparable to the results for Spring 2012 except for problem 9, in which two of the distracters were changed. Changing the distracters on problem 9 allowed us to see that 46% of the students fell into the "trap" of adding before multiplying when there are many operations in a problem. This mistake (and others) can be remedied by more practice on order of operations problems. Math 003 instructors will be encouraged to include order of operations review problems periodically after they are introduced the third week of the semester.

007	Data Analyzed and discussed at the Fall 2014 SLOs retreat. Summary: In comparing the Spring 2014 results with the Spring 2012 results, we see consistency in difficulty with signed numbers - order of operations and substitution and simplification, solving a proportion, solving a percent application, and simplifying an algebraic expression with signed coefficients. What surprised us was how much worse the students did Spring 2014 solving a simple equation with a fraction coefficient. Question 11 on the assessment, $\frac{3}{5}x = -9$, was answered correctly by 57% of the students for Sp 14 and 71% of the students in Sp 12. Question 6, also an equation to solve, was answered correctly by 76% of the students for Sp 14 and 89% of the students in Sp 12. The drop in the percent correct for solving a linear equation is concerning since the skill is so essential to be successful in the target course, Math 123. We have been concerned for sometime because there is currently not enough time to emphasize problem areas described above in class since so many topics are covered. Math 007 will be going through a curriculum change Fall 2014 to make it a 4 unit class (currently 3 units). In talking about how the assessment was administered, it was noted that one instructor gave it as a replacement quiz the week before finals and had results ready the next class meeting. The instructor was able to give the results out individually and counsel each student on specific topics to concentrate on in his/her final exam review. Items 13 and 14. Percentage of students who did not take Math 003 that are passing Math 007: 54/63 = 85.7% Percentage of students who did take Math 003 that are passing Math 007: 34/38 = 89.5%
008	Data Analyzed and discussed at the Fall 2014 SLOs retreat. **Summary Analysis:** Discussed and analyzed results at the SLO's retreat on August 13, 2014. Overall the results below were a little better than for the previous assessment. We need to follow the assessment results over time however to be confident in students improvement in their factoring skills after taking this course, since the sample sizes are fairly small. **SLO #1: Factor the polynomial using the Greatest Common Factor.** Question 3 on the sp 14 final: $-20x^5 - 18x^3$ Percent Correct: 13/15 about 87% Sp 12 - Percent Correct: 9/13 about 69% This is a nice improvement from the Sp 12 assessment. The Sp 12 assessment is lower than what we would expect from this type of factoring problem. **SLO #5: Factor the polynomial using the Difference of Squares Pattern.** Question 4 on the sp 14 final: $25x^2 - 49$ Percent Correct: 14/15 about 93% Sp 12 - Percent Correct: 11/13 about 85% A strong percentage of correct answers. Very similar to the Sp 12 results. **SLO #2: Factor the polynomial using Grouping**. Question 5 on the Sp 14 final: $6x^2 + 12xy - 7x - 14y$ Percent correct: 13/15 about 87% Sp 12 - Percent Correct: 9/13 about 69% For what is historically a difficult factoring problem, there was significant improvement from the Sp 12 assessment to the Sp 14 assessment. **SLO #6: Factor the polynomial using the Sum or Difference of Cubes Pattern.** Question 6 on the sp 14 final: $64x^3 - 1$ Percent Correct: 11/15 about 73% Sp 12 - Percent Correct: 10/13 about 77% A good result considering the difficulty that students have with factoring a cube pattern. The cube pattern is heavily emphasized in the math 008 class and the results are positive, but there was no evidence of improvement over previous assessments. **SLO #3: Factor a trinomial when the coefficient of the x^2 term is 1.** Question 7 on the sp 14 final: $x^2 - 3x - 28$ Percent Correct: 14/15 about 93% Sp 12 - Percent Correct: 11/13 about 85% Good result for a basic factoring problem. One student had the signs of the constants backwards.

	SLO#4: Factor a trinomial when the coefficient of the x^2 term is not 1. $12x^2-16x-3$ Question 8 on the Sp 14 final: Percent Correct: 12/15 80% Sp 12 – Percent Correct 9/13 about 69% Students find factoring a trinomial where the lead coefficient is composite number, difficult. The Sp 14 results show good improvement. Overall the student performed better on the Sp 14 assessment than they did on the Sp 12 assessment. These are encouraging results, so no substantial changes will be implemented in the course. However, the small sample sizes means we need to follow the assessments over time to see if it looks like students are improving significantly. With the positive results, the Division will look into offering the class on two Saturdays during a semester so that Intermediate Algebra students will have the opportunity to improve their factoring skills if they are substandard for the Intermediate Algebra level.
114	Data Analyzed and discussed at the Fall 2014 SLOs retreat. **Summary Analysis:** Math 114 has an enrollment cap of 20 and is a one unit support course of word problems for Math 123. Currently Math 114 is only offered on the NCC. The Spring 2014 assessment was taken by 12 students. 1) Integer problems: 100% correct. The results were as expected, very good – similar to the last assessment where 86% were correct. 2) Mixture problems: 75% correct. This is similar to the Sp 12 results where 71% of the students answered correctly. 3) Coin problems: 100% correct. This is an improvement over the 86% correct answers for the Sp 12 assessment. 4) Motion problem: 83% correct. These results are similar to the 86% percent correct for the Sp 12 assessment. 5) Geometry problem: 75% correct. This is an improvement over the 57% correct for the Sp 12 assessment. In Spring 12 his was the lowest scoring question and was a new addition to our assessment. We made the decision to add geometry to the assessment because we felt that more and more geometry is getting left out of the curriculum. The improved success rate for this question indicates that we are helping students get a better understanding of Geometric concepts.
	Program Outcome: *Prepare students to transfer to a four-year institution.*
236	Data Analyzed and discussed at the Fall 2014 SLOs retreat. **Summary Analysis** This was the first assessment after we adopted a new text book and also there were more questions this time and few changes from 2012. The results are significant since we had a good sample size of 184 and better results (with at least 5% improvement) to comparable questions from the last assessment. **Q1 Center of a distribution** Comparing 78.8% who got this question right this time to 59.09% in 2012, it seems removing the summation symbols and the results of some computations from 2012 problem was a right decision. The results could have been even better if the 12.5% who chose (a), mean as their answer worked on their vocabulary well and did not to mix up the different ways the center of a distribution can be measured. **Q2 Probability** This is a new question that replaces the 2012 question, which included an intersection symbol not used in our previous textbook. Considering the little time we spent on the topic and students' struggle when it comes to probability questions in general, 63.59% (compared to 47.16% in 2012) who got the question right is much higher than expected. **Q3 Sampling Distributions** We decided to switch "between" with "within" and the success rate went up from 32.39% in 2012 to 47.38% this time. The result could be considered good especially when the topic is covered in the middle of the semester and also a fairly large amount of information about the characteristics of population and sampling distributions (that can be mixed up easily) need to be remembered to answer the question correctly.

	Q4 Hypothesis Test for a population mean standard deviation known From the 2012 question, we got rid of an extra question that we believed was confusing and also changed the sample size larger in order to be able to work with the standard normal distribution instead of the student's t distribution. Here also we see an improvement – from 52.27% who got it right in 2012 to 57.61% this time. Needless to say this is a fairly complex and time consuming hypothesis testing question. **Q5 Linear Regression** We got rid of the True or False MiniTab print out question from 2012 altogether and decided to go with this one for the first time. Not surprisingly 86.41% got it right, considering this is the easiest and the least time consuming problem. Although it covers an important topic, probably it was too easy for a transfer level course and we may want to come up with a bit more challenging one instead for 2016. (Although $6.63 is fairly close to the highest $6.46, it is not in the range of corn prices and we would be extrapolating to get $13.51 as the correct answer.) **Q6 Goodness of Fit test** This is the first time we had six questions for the assessment and we decided to add this Goodness of Fit test as the last one. This is the question with the lowest success rate of 36.96%. Although this is a topic covered towards the end of the semester, expectations were not high since it is the last problem on the assessment and students are usually out of time by this point or just tired or simply don't remember what test to perform. Based on the 23.37% who chose (C), we think some students made errors as simple as rounding off errors. Perhaps we should go over this question again and provide more and/or specific information such as what test (Goodness of Fit) to perform or what test statistic (chi-square) they need to find or provide a table with observed and expected values to get started.
247	Data Analyzed and discussed at the Fall 2014 SLOs retreat. **Summary Analysis:** It should be noted that the entire Math 247 assessment tool needs to be reworked and a group of Math 247 instructors will be doing that over the course of the revision and implementation period. The current instructors don't feel the assessment tool accurately reflects what they want students to know and be able to do. 1. Success rate for this question have decreased 5 percentage points (or about a 9% decrease) since 2012, this may or may not be significant. Perhaps we could focus more on the median. Perhaps distractor (c) could be 11.0, Median, which they would find if they did not order the data before finding the median, and maybe (d) could be another answer, labeling it the mean, so that the median doesn't seem overrepresented. 2. Correct responses for this question have increased 7 percent points (or about a 35% increase) since 2012. This seems significant, however, a far greater majority is still choosing the most logical distractor of 0.5. The question is good, and students should certainly recognize flipping a coin several times and counting the number of heads as a binomial experiment. 3. Success rate for this question has decreased by 5 percentage points (or by 13%) since 2012. This is a topic that students should be familiar with, and perhaps they are thrown off by the wording. We should reword the question to be an interval of 97 to 103 pounds. This mirrors how many questions are worded during the semester. Also, it might help to give specific context such as 'mean weight of tigers in the wild is 100lbs with a standard deviation of 18 lbs' or something to that effect (instead of a particular numerical population'). 4. Success rate have increased by 7 percentage points (or 15%). There is a lot going on with this problem, is there a way to direct this question more? An incorrect response here could be due to any number of factors: wrong alternate hypothesis, wrong test statistic, wrong distribution, difficulty computing p-values using a t-table. It might be nice to adjust the problem to use a z-distribution so we might be directed toward where mistakes are being made, such as thinking it is 2-tailed instead of 1. 5. Correct responses dropped by 17 percentage points (or 20% decrease). Is this question really targeted at what we want to determine? How much time is spent doing hypothesis tests about the fit of a regression line? The topic of regression lines takes up 1-2 hours of a semester, and it seems like r and r^2 are more indicative of what we look at than a hypothesis test about the linear fit. I think we could remove the '.05 significance' without losing the importance of the question so that they could look at the p-value or r^2 in order to answer the question correctly.

Spring 2015

Group A **Analyze**

Course	Action
	Program Outcome: *Build competencies in basic mathematical skills to help students achieve their academic Goals.*
021	Data discussed analyzed at the Spring 2015 SLOs retreat. Summary: See Math 123
122	Results analyzed at the Spring 2015 SLOs retreat. Summary: See Math 123
123	Data discussed and analyzed at the Spring 2015 SLOs retreat. Summary: 290 students were surveyed (262 in Math 123, 14 in Math 021, 14 in Math 122). 75% of the students stated they were passing; 12% stated they were not passing; 13% stated they didn't know whether they were passing or not. This (perceived) success rate is a considerable improvement over that from the previous SLOA cycle (performed in 2012), where 19% stated they were not passing the course. Approximately the same percentage of students weren't sure about their standing in the course (13%, 2014; 14%, 2012). This could indicate some work to be done in helping students keep track of their grade in the course. The Demographic/Grade Report data should have Chi-Squared Analysis performed to determine whether there is any correlation between students having taken Math 007 and their perceived standing in the course (passing or not). Q1: Multiply and simplify a polynomial expression. 72% answered correctly. This was about the same percentage as the last assessment cycle (73%) . Instructors should continue emphasizing the distribution of a negative sign through the parentheses. Looking at the distracters this was still the most common mistake. Remind instructors in Action Plan to emphasize negative sign distribution. Q2: Factor a trinomial with a leading coefficient other than 1. 57% answered correctly. The results were about the same as last time (55%). Based on the distracters, the common errors were ignoring the leading coefficients or possible sign errors. The success rate with this topic has been consistently on the low side (61%, 55%, and 57% in the last 3 cycles. Suggest that instructors teach multiple techniques for factoring. We may want to change this SLO. Q3: Find the equation of the line passing through two points. 48% answered this question correctly. These results were about the same as for the last assessment (45%). Based on the distracters, the students appear to be finding the slope correctly but are still confusing the concept of "y-coordinate" versus "y-intercept". The textbook often lists the y-intercept as "2". Last time: Let instructors know the students are finding slope well but need practice in finding the entire line equation. Emphasize vocabulary. Q4: Graph a linear equation written in general form. 65% answered correctly. These results are slightly lower than those of the last assessment (71%). Students generally do better with graphing linear equations than finding them as seen in Q3 and Q4. We changed distracter "c" so the line would have a negative slope to get better information as to the mistakes students are making. The students chose all three of the distractors at about the same rate (11 – 13 %) Be sure to review graphing a line in General Form using intercepts. Q5: Solve a linear equation containing fractions. 49% of the students answered this correctly which is a

	slight improvement over last time (45%). Looking at all the distracters and how students answered we surmised that students were guessing and not taking the time to actually do the problem. These are difficult problems for students at this level. We noticed that students are not consistent in distributing on both sides of the equation. We will modify the question to remove the initial parentheses. Q6: Set up an application problem. There was a serious error in this question on the Math 123 assessment: the word "area" had been mistakenly changed to the word "perimeter" thus making the units given in the problem incompatible. The Math 122 assessment question (number 4) correctly had the word "area" and 71% of the students answered the question correctly which is a slight improvement over the results from last cycle (63%). 44% of the students in Math 123 chose the correct distractor based on the word "perimeter", and 32% chose the correct answer based on the units. These results aren't really meaningful. Based on student answers there is still some confusion over perimeter versus area. Vocabulary strengthening is a recurring theme on this assessment. Q7: Addition of "unlike" radicals. 71% of the students answered this correctly which is a slight improvement over the last assessment (64%). It's noteworthy that the Math 122 students did much worse on this question, with only 57% answering the question correctly. Instruction on this topic seems to be fairly effective. Remind students to simplify radicals before combining. Note: The responses on the Math 021 and 122 assessments were about the same as those on the Math 123 assessment, except as noted in Q6. Other discussion: We will be investigating whether to actually change our SLO's to be more general. We also would like to improve consistency of results by having all instructors incorporate the SLOA questions in the final exam.
	Program Outcome: *Prepare students to earn an AA/AS Degree*
126A	Data discussed and analyzed at the Spring 2015 SLOs retreat. Summary: See Math 127
126B	Data discussed and analyzed at the Spring 2015 SLOs retreat. Summary: See Math 127
127	Data discussed and analyzed at the Spring 2015 SLOs retreat. Summary: We are removing the "none of the above" option from all of the questions because that tends to be the most popular wrong answer. This will allow us to better track partial understanding based on other question choices. We plan to add basic concept and vocabulary checks to the required homework assignment sheet because students need more explicit drill on math vocabulary and re-enforcement of basic concepts that guide a process. Q1: Solving Rational functions stayed at about 57% correct. Q2: Solving a system of Equations improved 8% to about 48%. Q3: Solving a variation problem went down 2% to 32%. Students still getting this partially correct. They are either forgetting to square the distance or they construct direct variation instead of inverse variation. We are going to create a worksheet on variation problems that instructors can use to supplement the text. Students need more practice in careful reading of the problems. Q4: Finding a composite function went back up to 60%. Students continue to find the product rather than the composition or take the wrong order of composition. Q5: Finding the vertex rose a bit to 34%. Students continue to either find the x-coordinate of the vertex and stop or find the y-intercept. Vocabulary needs to be emphasized. Q6: Finding a logarithm went up a little to 55%. We are changing the question to a simpler one that determines just if they know the definition a logarithm.

128	Data discussed and analyzed at the Spring 2015 SLOs retreat. Summary: Demographic/Grade Report 55 students were surveyed Only 56% of the students stated they were passing; 7% stated they were not passing; A whopping 37% stated they didn't know whether they were passing or not. **Action: Instructors should help students keep track of their grades in the course.** A total of 33% of students stated they had taken Math 007 at Cuesta. This information is too general to be of much use since students could have taken and passed up through Math 123 and still have answered "yes" to this question. **Action: We need to determine what kind of information we're trying to gather with this question then refine the question accordingly or dispense with it.** Q1: Identify and model linear data. 56% answered correctly. 13% chose the wrong sign on the slope. 16% chose the wrong y-intercept. 13% inverted the slope. No students chose the inverted slope AND the wrong y-intercept. **Action: Work on the meaning of slope in the context of the problem (should eliminate sign and inversion errors). Work on the meaning of the y-intercept (initial value).** Q2: Identify and model exponential data. 36% answered correctly. 62% chose the data with the linear pattern. This may be due to the fact that the students didn't see enough problems quite like this; the emphasis, at least in the problems in the text, was on the identification of exponential data rather than the generation of it. No students chose the oscillating distractors. **Action: Possibly change the question to one of identifying an exponential vs. linear set of data and/or writing the equation of an exponential model based on a set of data which were the concepts emphasized in the course. Current question doesn't quite match the SLO.** Q3: Analyze scatterplots in terms of correlation; discern the difference between correlation and causation. 47% answered correctly. 76% of the students recognized that the data have negative correlation which is the good news. 33% of the students thought there was a causal relationship between hot chocolate sales and crime rate, which is the bad news. **Action: Keep reminding students throughout the course that "correlation is not causation"; keep finding absurd correlations (such as the one in this question) to emphasize this fact. Look at vocabulary change; "causal" is confusing!** Q4: Solve a quadratic equation in an applied situation. Only 23% of the students solved this problem correctly. The problem (one involving free-fall) should have been familiar to them but multiple choice answer format (finding the sum of the times) was not so at this level this could have caused some confusion. There were the most number of blanks on this question as well (6 left blank, so over 10% of the students, vs. 2 or fewer blanks on the others). **Action: Perhaps modify the question by asking them specifically add the times then answer the question.**

	Q5: Use logarithms in an applied context (Richter scale, pH, decibel level, etc.) Only 27% of the students answered this question correctly. 49% of the students took the log of the pH value instead of the inverse log. **Action: Students find these applications quite challenging. Spend more time on these applications. A supplement on these applications would be helpful, especially pH for the pre-nursing students. Students weren't clear on what is an input or output.** Q6: Use probability in an applied setting. Only 24% of the students answered correctly. Students really struggle with the concept of probability. In the interest of serving the pre-stats students, we need to place much more emphasis on probability and dealing with more complex sample spaces than just a bag of marbles. Action: Fix the answer key on this problem. Other discussion: This is a fairly challenging assessment relative to what is given in other courses.

Group B Assess

Course	Action
	Program Outcome: *Prepare students to transfer to a four-year institution.*
229	Assessment revisions discussed and approved at Spring 2015 SLOs retreat
231	Assessment revisions discussed and approved at Spring 2015 SLOs retreat
230	Assessment revisions discussed and approved at Spring 2015 SLOs retreat
232	Assessment revisions discussed and approved at Spring 2015 SLOs retreat
242	Assessment revisions discussed and approved at Spring 2015 SLOs retreat

Group C Revise and Implement

Course	Action
	Program Outcome: *Prepare students to transfer to a four-year institution.*
255	Revision and Implementation Stages
265A	Revision and Implementation Stages.
265B	Revision and Implementation Stages
	Program Outcome: *Prepare student for math A.S. and/or A.S.-T. Degree*
283	Revision and Implementation Stages
287	Revision and Implementation Stages

Group D Revise and Implement

Course	
	Program Outcome: *Build competencies in basic mathematical skills to help students achieve their academic Goals.*
003	Revision and Implementation Stages
007	Revision and Implementation Stages.

008	Revision and Implementation Stages
114	Revision and Implementation Stages
	Program Outcome: *Prepare students to transfer to a four-year institution.*
236	Revision and Implementation Stages
247	Revision and Implementation Stages