Department of Mathematics SLO Summary: Report 2011 – 2012

The completed Assessment Worksheets are available in the Department archives. 70% is the minimum acceptable success rate for any SLO.

Math C020: This course has seven SLOs. All SLOs had at least 70% success rates except the following:

Outcome C: 68%
Outcome D: 69%
Outcome E: 67%
Outcome G: No results exist.

Outcome Assessments and Definitions
Outcome C: Upon successful completion of this course 70% of the students should be able to calculate sums, differences, products, and quotients involving fractions and mixed numbers and apply to real-life examples.

Outcome D: Upon successful completion of this course 70% of the students should be able to solve problems involving decimals using the operations of addition, subtraction, multiplication and division.

Outcome E: Upon successful completion of this course 70% of the students should be able to convert numbers between decimals, fractions and percents and employ this skill to solve applications.

Outcome G: Upon successful completion of this course 70% of the students should be able to demonstrate time management skills through the use of a study log.

Plans for Improvement and Reassessment
1. Demystifying fractions is at the heart of success in this outcome. Some students have never made the connection between fractions and real life. Fractions live as an obscure symbolism created by mathematicians to prevent them from achieving their goals. For Math C020, this may mean finding relatable manipulatives: pizza, cake, money, puzzles, handheld items with parts, and so on.
2. Mixed fractions should similarly broken down for conceptual clarity.
3. Quizzes and practice exams are good after clear distinctions are made about the methods of combining fractions.
4. Many students get into prealgebra and algebra without understand what fractions are, so applications could be presented conceptually first with answers that are approximations before using rules and processes. Afterwards, they may be solved with reflection as to what we inferred from the beginning. In other words, it may be helpful to check the answer before solving the question. Have students verbalize/(or write down) the process of working each type of problem can be useful in Outcome C.
1. It appears that students need more practice as well as feedback as to whether they are really mastering computations involving fractions. Giving a mid chapter quiz which must have a

score of 70% or higher in order to proceed may provide this feedback and point out any weaknesses early.
2. Improve multiplication skills by giving a timed multiplication quiz.
3. Require an 80% or higher on a practice exam involving computations with fractions prior to the actual exam.
4. In the case of real-life examples, we could emphasize checking answers as to whether or not they are reasonable in the context of the original problem.
A clear conveyance of what a prime number is, and how all positive integers (except 1) are products of prime numbers is important. Perhaps developing a stronger approach to prime factorization and the construction of factor trees is called for. Regarding Outcome C, my suggestion for improving the result is to emphasize prime numbers, prime factorization and their strong connections to fractions. I also find it helpful to emphasize the meaning of a simplified fraction.

The e-mail trail of Departmental discussion follows.

From: Bob Phung
Sent: Sat 9/10/2011 1:12 AM
To: Dean Bernsten; Bob Phung; Steve Rogers; Rachel Winston; Dean Bernsten; Yihfen Chen; Joe Slovacek
Subject: RE: SLO Discussions
Regarding Outcome C, my suggestion for improving the result is to emphasize prime numbers, prime factorization and their strong connections to fractions. I also find it helpful to emphasize the meaning of a simplified fraction. Regarding Outcome D, We have 69% success rate. The difference of 1% might be statistically insignificant. Regarding Outcome E, probably we missed the mark due to students' difficulties in dealing with percent problems. Clearly, there are different ways to approach percent problems. I find it helpful to use fraction notation to represent percent instead of decimal; it seems more natural to interpret and represent a percent in a problem. We should also put strong emphasis on solving equations from the perspective of applying addition property of equality and multiplication property of equality.
Bob Phung
Department of Mathematics
Cerro Coso Community College

From: Dean Bernsten
Sent: Sat 9/10/2011 7:02 AM
To: Bob Phung; Bob Phung; Steve Rogers; Rachel Winston; Dean Bernsten; Yihfen Chen; Joe Slovacek
Subject: RE: SLO Discussions
Bob,
Thanks for your quick response.
Outcome C: I agree. A clear conveyance of what a prime number is, and how all positive integers (except 1) are products of prime numbers is important. Perhaps developing a stronger approach to prime factorization and the construction of factor trees is called for.
Outcome D: I'd like to take the "close enough for government work" on this one as well; however, the four arithmetical operations being measured are the backbone of this course. We

have two things to contend with: decimals and arithmetic. I think it's the arithmetic that stands in the way. Perhaps devoting fifteen minutes of every lecture to an addition, subtraction, multiplication, and division problem would help. In my opinion, students learn this material best by way of constant repetition -- overseen by the instructor.
Outcome E: I see a couple of obstacles: conversion of improper fractions to mixed numbers and vice versa, and reading comprehension. This may sound draconian, but having students read word problems aloud, in class; and then the instructor leading a class discussion of the word problem's content and an approach to its solution may be helpful.
Dean

From: Steve Rogers
Sent: Sat 9/10/2011 8:14 AM
To: Dean Bernsten; Bob Phung; Bob Phung; Rachel Winston; Yihfen Chen; Joe Slovacek
Subject: RE: SLO Discussions
All,
Here are my thoughts on improving success rates for specific Math 20 SLOs
Outcome C: Upon successful completion of this course 70% of the students should be able to calculate sums, differences, products, and quotients involving fractions and mixed numbers and apply to real-life examples.
1. It appears that students need more practice as well as feedback as to whether they are really mastering computations involving fractions. Giving a mid chapter quiz which must have a score of 70% or higher in order to proceed may provide this feedback and point out any weaknesses early.
2. Improve multiplication skills by giving a timed multiplication quiz.
3. Require an 80% or higher on a practice exam involving computations with fractions prior to the actual exam.
4. In the case of real-life examples, we could emphasize checking answers as to whether or not they are reasonable in the context of the original problem.
Outcome D: Upon successful completion of this course 70% of the students should be able to solve problems involving decimals using the operations of addition, subtraction, multiplication and division.
1. These problems that involve computations with decimals are often subject to errors because of incorrect decimal placement and/or lack of neatness of written work (i.e. not keeping place values lined up correctly). A written quiz where students need to find their errors and correct them may help reduce these errors.
2. Require an 80% or higher on a practice exam involving computations with decimals prior to the actual exam.
Outcome E: Upon successful completion of this course 70% of the students should be able to convert numbers between decimals, fractions and percents and employ this skill to solve applications.
1. The improvement of scores for outcomes C and D should help improve scores for this outcome as well.
2. Emphasize simplifying answers as some students may forget to do this and get the problems wrong. For the problems associated with this SLO many of the answers need to be entered in a specific format (i.e. simplified fraction, a decimal rounded to a particular place value, or as an integer, whole number or percent.) Requiring the practice exam as a

prerequisite to the actual exam would very likely reduce the amount of errors due to an incorrect format of the answer.
Steve

From: Dean Bernsten
Sent: Sun 9/11/2011 11:41 AM
To: Steve Rogers; Bob Phung; Bob Phung; Rachel Winston; Yihfen Chen; Joe Slovacek
Subject: RE: SLO Discussions
Steve,
Great feedback, thanks!
Dean

From: Yihfen Chen
Sent: Sun 9/11/2011 10:00 PM
To: Dean Bernsten; Steve Rogers; Bob Phung; Bob Phung; Rachel Winston; Joe Slovacek
Subject: RE: SLO Discussions
All,
Have students verbalize/(or write down) the process of working each type of problem can be useful in Outcome C, D, and E.
~Yihfen

From: Rachel Winston
Sent: Mon 9/12/2011 5:56 AM
To: Yihfen Chen; Dean Bernsten; Steve Rogers; Bob Phung; Bob Phung; Joe Slovacek
Subject: RE: SLO Discussions
From:
All,
Outcome C: Upon successful completion of this course 70% of the students should be able to calculate sums, differences, products, and quotients involving fractions and mixed numbers and apply to real-life examples.
1. Demystifying fractions is at the heart of success in this outcome. Some students have never made the connection between fractions and real life. Fractions live as an obscure symbolism created by mathematicians to prevent them from achieving their goals. For Math C020, this may mean finding relatable manipulatives: pizza, cake, money, puzzles, handheld items with parts, and so on.
2. Mixed fractions should similarly broken down for conceptual clarity.
3. Quizzes and practice exams are good after clear distinctions are made about the methods of combining fractions.
4. Many students get into prealgebra and algebra without understand what fractions are, so applications could be presented conceptually first with answers that are approximations before using rules and processes. Afterwards, they may be solved with reflection as to what we inferred from the beginning. In other words, it may be helpful to check the answer before solving the question.
Outcome D: Upon successful completion of this course 70% of the students should be able to solve problems involving decimals using the operations of addition, subtraction, multiplication and division.

1. Ultimately, the problem with this objective is the same as fractions. Students learn to move the decimals and follow operations without having any idea what a decimal is. Thus, they learn procedures because it is a requirement rather than learning because it is useful. At some point in their life, they put the puzzle pieces together and begin to see the light.
2. Learning how to use decimals might begin with why organization of work, decimal placement, and keeping track of how many decimals there are makes a difference. Most people can accept a how if they know why.
3. Application questions might begin with approximating answers and then solving to find the exact value. In this way students can relate exact and approximate answers.
Outcome E: Upon successful completion of this course 70% of the students should be able to convert numbers between decimals, fractions and percents and employ this skill to solve applications.
1. Games might work here. These might be presented from an internet source that shows images and then has students choose which fraction or which decimal is closest to the image. After an initial lecture on the relationship between fractions and decimals, non stressful "quizzes" could allow students to compare fractions and decimals to approximate which is closer to an image of that part of the whole.
2. Similarly, simplifying answers can begin conceptually so that "see" that 5/5 = 1 or that 3/12 = 1/4. After students understand, then they can better grasp the process.
Rachel

Math C040: This course has seven SLOs. All SLOs had at least 70% success rates except the following:

Outcome D: 65%
Outcome G: 68%

Outcome Assessments and Definitions
Outcome D: Upon successful completion of this course 70% of the students should be able to add, subtract, and multiply polynomials and be able to evaluate algebraic expressions. This outcome will be assessed and scored by the Chapter 10 exam.

Outcome G: Upon successful completion of this course 70% of the students should be able to apply basic graphing techniques. This outcome will be assessed and scored by problems 14 through 22 from Chapter 6 Exam.

Plans for Improvement and Reassessment

The e-mail trail of Departmental discussion follows.

-----Original Message-----
From: Dean Bernsten
Sent: Wed 9/14/2011 7:20 AM
To: Bob Phung; Steve Rogers; Rachel Winston; Dean Bernsten; Yihfen Chen; Joe Slovacek
Subject: SLO Dialog: Math C040
All,
Please give me input on Outcome G, Plan for Improvement and Reassessment. It would be nice to have all of your responses in by Sunday, September 18.
Thanks,
Dean

From: Joe Slovacek
Sent: Thu 9/15/2011 7:59 AM
To: Dean Bernsten; Bob Phung; Steve Rogers; Rachel Winston; Yihfen Chen
Subject: RE: SLO Dialog: Math C040
Here goes:
G. Apply basic graphing techniques. This outcome will be assessed and scored by exam.
Plan for improvement --> recommend that:
1. Students do more graphing exercises "by hand" using paper, pencil, and ruler; minimal to no computer or calculator graphing.
Basic points, lines, and figures.
2. Students do more "applied graphing" using measuring instruments: rulers, tape measure, scales, etc.; examples:
(a) Measure and draw object using key points on a rectangular coordinate system (computer graphics application)
(b) Make a map of a small plot near the building illustrating key plants, ant colonies, etc., on a rectangular coordinate system.
Students would have to make a grid and measure distances and locations relative to that grid (Biology & Environmental Science Application.
(c) Take Biophysical measurements such as height, weight, blood pressure & O2 saturation (easy to do with inexpensive instruments - e.g.,
$50 at Rite-Aid) and graph the data on various types of graphs, e.g., line, bar, pie charts. (Health Science application)
(d) Take Distance/Time data of moving objects such as student's walking, model trains, scale model monorails, etc., and graph on a
rectangular coordinate systems. (Physics & Engineering application).
(e) Take a bucket of soil/dirt and sort out the rocks, pebbles, and cobbles; make various graphs of the data (Geology application)
(f) Etc.
Joe

From: Bob Phung
Sent: Fri 9/16/2011 1:35 PM
To: Joe Slovacek; Dean Bernsten; Steve Rogers; Rachel Winston; Yihfen Chen
Subject: RE: SLO Dialog: Math C040

All,

I think the problem regarding this issue is not much about graphing points; the problem is more about given a linear equation in two variables, derive the ordered pairs from the equation to graph. In general, students tend to have more difficulties with equation with two variables. My opinion on how to improve this area is to have students to build a table illustrated below.

Given y=2x+3,

x	y=2x+3	Ordered Pair
0	2(0)+3=3	(0,3)
1	2(1)+3=5	(1,5)
2	2(2)+3=7	(2,7)
3	2(3)+3=9	(3,9)

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Bob Phung
Department of Mathematics
Cerro Coso Community College

From: Dean Bernsten
Sent: Fri 9/16/2011 1:37 PM
To: Bob Phung; Joe Slovacek; Steve Rogers; Rachel Winston; Yihfen Chen
Subject: RE: SLO Dialog: Math C040

Joe and Bob,

Many thanks for the thoughtful responses. You guys are Marines.

Dean

From: Dean Bernsten
Sent: Wed 9/14/2011 7:20 AM
To: Bob Phung; Steve Rogers; Rachel Winston; Dean Bernsten; Yihfen Chen; Joe Slovacek
Subject: SLO Dialog: Math C040

All,

1. Convince students that obtaining a sharpened pencil, straightedge, and graph paper will make graphing an easier and more enjoyable experience.
2. Emphasize the use of a table of x- and y-values, and how these values are related as coordinate pairs.
3. Emphasize the relationship between tabular values and pictographs.
4. Relate bar graphs and line graphs to "real world" observations like age, weight, GPA, gender, etc.
5. Exercise the student's ability to substitute values into one variable to solve for the second variable.
6. Incorporate the presumably already learned skill of algebraic variable isolation into equations that contain two variables.

Dean

From: Steve Rogers
Sent: Sun 9/18/2011 11:34 AM
To: Dean Bernsten; Bob Phung; Rachel Winston; Yihfen Chen; Joe Slovacek
Subject: RE: SLO Dialog: Math C040

All,

OUTCOME G - Upon successful completion of this course 70% of the students should be able to apply basic graphing techniques.

1. I have found that when students first begin plotting points, a common error is to mix up the x and y coordinates. Perhaps we could use other letters (a,b) and (m,n) to emphasize the fact that the letter that comes first in the alphabet corresponds to **h**orizontal movement which is done prior to **v**ertical movement just as h comes before v in the alphabet even though not consecutively.
2. Another common error students typically have when finding an ordered pair to $4x-3y=11$ when $y = -1$ is working with negative numbers. A sign error here will definitely lead to an incorrect graph. We could emphasize that students plot a minimum of three points for linear graphs which can catch a sign error graphically.
3. To graph $y = (-\frac{2}{3})\ x$ we can stress that multiples of three would be easiest to work with for x values. When we say to students, let x be equal to 3, they often don't understand why x can be 3. We should emphasize the fact that x is independent and can be freely chosen so why not pick a number that is easy to compute.
4. Distinguish the difference in graphing procedure (or in making an input/output table) when an equation is explicitly solved for y and when it is not.

Steve

From: Yihfen Chen
Sent: Sun 9/18/2011 9:56 PM
To: Dean Bernsten; Bob Phung; Joe Slovacek; Steve Rogers; Rachel Winston
Subject: RE: SLO Dialog: Math C040

Agree with all your suggestion. I also would like to emphasize that graphing an equation (the line) is graphing all the solutions of the equation.

Yihfen

From: Rachel Winston
Sent: Mon 9/19/2011 10:04 PM
To: Yihfen Chen; Dean Bernsten; Bob Phung; Joe Slovacek; Steve Rogers
Subject: RE: SLO Dialog: Math C040

All,

What I can add is to help students develop a conceptual understanding of bar and line graphs.

1. Help students better understand variables and how bar and line graphs can help them compare variables.
2. Provide a visual interpretation of the meaning of the graphs.
3. Demonstrate increases and decreases over time or as a function of another variable.
4. Use real world "points" can improve comprehension.

Rachel

Math C050: This course has six SLOs. All SLOs had at least 70% success rates except the following:

Outcome B: 62%
Outcome C: 61%
Outcome E: 65%

Outcome Assessments and Definitions

Outcome B: Upon successful completion of this course 70% of the students should be able to perform operations with polynomials, including factoring. This outcome will be assessed and scored by problem 17, 36, 37, 38, and 40 from Chapter 4 Exam, and problems 11, 16, 18, 20, and 26 from Chapter 5 Exam.

Outcome C: Upon successful completion of this course 70% of the students should be able to graph equations and inequalities in one and two dimensions, including applying the concept of slope. This outcome will be assessed and scored by Chapter 3 Exam.

Outcome F: Upon successful completion of this course 70% of the students should be able to translate between English phrases and sentences and mathematical expressions and equations to solve applications. This outcome will be assessed and scored by problems 23 through 32, and 34 from Chapter 2 Exam.

Plans for Improvement and Reassessment

A synopsis of the e-mail trail of Departmental discussion follows.

Outcome B

Upon successful completion of this course 70% of the students should be able to perform operations with polynomials, including factoring.

Since we're dealing with polynomials, let us agree that the general form of an n_{th} degree polynomial is $a_n x_n + a_{n-1}x_{n-1} + a_{n-2}x_{n-2} + \cdots + a_2x_2 + a_1x + a_0$ where $a_n \neq 0$, and all exponents are non-negative integers.

1. Define an integer, specifically a non-negative integer.
2. Define an addend.
3. Define a factor.
4. Define a term.
5. Define common factors, and explain that the quotient of two common factors is 1.
6. Define like terms, and explain that like terms can be added to and subtracted from one another. Furthermore, point out that one like term subtracted from an identical like term yields 0.
7. Differentiate between the definitions of common factors and like terms.
8. Point out that common factors can be cancelled by way of multiplication or division, and that like terms can be simplified or combined by way of addition or subtraction.
9. Make sure the student has a solid grasp of the Commutative and Associative Properties of addition and multiplication.
10. Explain the Distributive Property in detail.

11. Demonstrate the reverse of the Distributive Property, and this is the key to factoring polynomials.
12. Demonstrate multiplication of monomials by binomials using the Distributive Property. Make sure that like terms are combined.
13. Demonstrate multiplication of binomials by binomials using the Distributive Property.

Outcome C
Upon successful completion of this course 70% of the students should be able to graph equations and inequalities in one and two dimensions, including applying the concept of slope.
1. Present axes and labeling of the Cartesian coordinate system. Identify all four quadrants.
2. Emphasize that each point in the Cartesian plane is a coordinate pair, generically expressed as (x, y).
3. Explain that all points in a particular quadrant share the same characteristics. For example, if a point is in first quadrant, then it has a positive x-coordinate and a positive y-coordinate.
4. Point out that all points on the x-axis have a zero y-coordinate, and that all points on the y-axis have a zero x-coordinate.
5. Explain that in order to identify (x, y), begin at the origin $(0, 0)$ and move x units in the horizontal direction (negative implies left, and positive implies right), and y units in the vertical direction (negative implies down, and positive implies up).
6. Explain y- and x-intercepts.
7. Explain the concept of the slope of a line. Show how to find the slope using two points and the slope formula.
8. Introduce and apply the general linear equation, the slope-intercept form, and the point-slope form of a line.
9. Introduce the substitution and elimination methods in solving a system of two equations with two unknowns. Use the results of these methods to demonstrate the intersection of two lines and that parallel lines do not intersect.
10. Explain how regions in the Cartesian coordinate system are created by intersecting or parallel lines. Show how sets of points are concurrently less than, less than or equal, greater than, or greater than or equal to both lines.

Outcome F
Upon successful completion of this course 70% of the students should be able to translate between English phrases and sentences and mathematical expressions and equations to solve applications.
1. Emphasize that grasping a word problem's meaning is a multi-stage process.
a. Emphasize that certain English words can be directly translated into a mathematical symbol or operation, for example, is means =, and or increase means +, from or decrease means –, of means ×, per means ÷.
b. Skim over the problem.
c. Re-read the problem slowly.
d. Draw a picture of the described situation.
e. Assign each variable a relevant meaning, for example, "Let x be the number of feet across the river".
f. Make a table of variables and their values, if applicable.
g. Hold their hands.

Math C055: This course has eleven SLOs. All SLOs had at least 70% success rates except the following:

Outcome D: 59%
Outcome E: 65%
Outcome F: 59%
Outcome K: 67%

Outcome Assessments and Definitions

Outcome D: Upon successful completion of this course 70% of the students should be able to recognize the difference between functions and non-functions. This outcome will be assessed and scored by problems 13, 14, and 15 in Chapter 3 Exam.

Outcome E: Upon successful completion of this course 70% of the students should be able to graph a line and write the equation of a line. This outcome will be assessed and scored by Chapter Exam 3.

Outcome F: Upon successful completion of this course 70% of the students should be able to recognize and graph at least one quadratic – parabola, circle, ellipse, or hyperbola. This outcome will be assessed and scored by problems 11, 13, and 14 from Chapter 9 Exam.

Outcome K: Upon successful completion of this course 70% of the students should be able to set up and solve word problems related to the skills above. This outcome will be assessed and scored by problem 6 from Chapter 1 Exam, problem 18 from Chapter 2 Exam, problem 16 from Chapter 3 Exam, problem 3 from Chapter 4 Exam, problem 16 from Chapter 6 Exam, problem 14 from Chapter 7 Exam, problem 14 from Chapter 8 Exam, problem 9 from Chapter 9 Exam, and problem 20 from Chapter 10 Exam.

Plans for Improvement and Reassessment

A synopsis of the e-mail trail of Departmental discussion follows.

Outcome D

Upon successful completion of this course 70% of the students should be able to recognize the difference between functions and non-functions.

Point out that when comparing input and output tables to determine which represents a function, only the ones that have a repeated domain value will contain more than one output for a given input and therefore will not be functions. Relate this to the vertical line test.

Outcome E

Upon successful completion of this course 70% of the students should be able to graph a line and write the equation of a line.

Enforce the procedure of checking your graph as part of the graphing method.

1. Graphing a minimum of 3 points will help detect sign and algebraic errors when graphing ordered pairs.
2. Putting equations in slope-intercept form will allow students to check graphs with rise over run as well as develop equation writing skills.

Outcome F

Upon successful completion of this course 70% of the students should be able to recognize and graph at least one quadratic – parabola, circle, ellipse, or hyperbola

I like to emphasize transformations from the parent function y=x^2 in the graphing of quadratics. As the outcome states they will be able to "recognize " as well as graph these functions so recognizing incorrect transformations such as an upward pointing parabola when the coefficient of the squared term is negative should help.

Outcome K

Upon successful completion of this course 70% of the students should be able to set up and solve word problems related to the skills above

1. Point out the similarities of the word problems between the different chapters in this course. For example many of the word problems involving one variable are set up with a table in the exact same manner as a problem involving two variables. When the students see that they have done this before, the process will be familiar.
2. Point out the similarities in the tables used for various types of problems. For example mixture, motion, interest problems all have a rate column.
3. In motion problems emphasize recognizing what is the "key" to the given situation. Are the distances, times or rates additive, are they the same etc.?

Outcome D: I don't see any other way to approach this topic other than introducing this topics mathematically, the way it is meant to be introduced. Relations and functions are the first more abstract mathematical concepts students at this level encounter for the first time. Maybe students' ability to tell the distinction between a relation and a function is sufficient at this level. The ability to distinguish the two concepts is not difficult. A relation is a set of ordered pairs. A function is a special relation where the first components of any two ordered pairs in the set are different. Emphasize that a function is a special relation.

Examples:

{(1,2), (1,5), (5,4)} is a relation, but not a function because 1 is in both (1,2) and (1,5).

{(4,2), (1,4), (5,4)} is a function which is also a relation. The first components of any two ordered pairs in
the set are different.

Outcome E: I believe we talked about this very same topic when we did Mathc040. My suggestion at the time was to build a table like the one below.

Given y=2x+3,

x	y=2x+3	Ordered Pair
0	2(0)+3=3	(0,3)
1	2(1)+3=5	(1,5)
2	2(2)+3=7	(2,7)
3	2(3)+3=9	(3,9)

Emphasize that linear equation in slope y-intercept form can be achieved by simply solving the y.

Outcome F:
I had my students to familiarize themselves with the summary on this web page below.
http://math2.org/math/algebra/conics.htm

Outcome K:
In solving word problem, translating relevant information from English into Algebraic expressions and equations is 90% of the battle. Most students' difficulty with word problems is in translation. There is nothing more for me to add other than I strongly agree with what Dean said below regarding this outcome.

Outcome D
Upon successful completion of this course 70% of the students should be able to recognize the difference between functions and non-functions.
This outcome will be assessed and scored by problems 13, 14, and 15 in Chapter 3 Exam.
1. Define a relation.
2. Define a function.
3. Demonstrate that functions are subsets of relations, but relations are not subsets of functions.
4. Vertical line test of an equation's graph.

Outcome E
Upon successful completion of this course 70% of the students should be able to graph a line and write the equation of a line.
This outcome will be assessed and scored by Chapter Exam 3.
1. Make tables of points in the form (x, y).
2. Explain slope.
3. Explain the y-intercept.
4. Explain the slope-intercept, point-slope, and general linear form of a line.

Outcome F
Upon successful completion of this course 70% of the students should be able to recognize and graph at least one quadratic – parabola, circle, ellipse, or hyperbola.
This outcome will be assessed and scored by problems 11, 13, and 14 from Chapter 9 Exam.
1. Slice cones at different angles with planes to help graphically demonstrate what the term "conic section" means.
2. Graphically define a parabola, circle, ellipse, or hyperbola in terms of a set of points with special distance relationships to foci and directrices.
3. Derive the general formulas for the above conic sections based on their graphical definitions.

Outcome K
Upon successful completion of this course 70% of the students should be able to set up and solve word problems related to the skills above.
This outcome will be assessed and scored by problem 6 from Chapter 1 Exam, problem 18 from Chapter 2 Exam, problem 16 from Chapter 3 Exam, problem 3 from Chapter 4 Exam, problem 16 from Chapter 6 Exam, problem 14 from Chapter 7 Exam, problem 14 from Chapter 8 Exam,

problem 9 from Chapter 9 Exam, and problem 20 from Chapter 10 Exam.
1. Emphasize that grasping a word problem's meaning is a multi-stage process.
a. Emphasize that certain English words can be directly translated into a mathematical symbol or operation, for example, is means =, and or increase means +, from or decrease means –, of means ×, per means ÷.
b. Skim over the problem.
c. Re-read the problem slowly.
d. Draw a picture of the described situation.
e. Assign each variable a relevant meaning, for example, "Let *x* be the number of feet across the river".
f. Make a table of variables and their values, if applicable.

Math C056: This course has three SLOs. All SLOs had at least 70% success rates.

Math C101: No SLOs have been assessed.

Math C121: This course has four SLOs. Only SLO A had at least a 70% success rate.

Outcome B: 58%
Outcome C: 60%
Outcome D: 51%

Outcome Assessments and Definitions
Outcome B: Upon successful completion of this course 70% of the students should be able to have a basic literacy in the areas of probability and statistics. This outcome will be assessed and scored by Chapter 4 Exam.

Outcome C: Upon successful completion of this course 70% of the students should be able to follow and evaluate a statistical line of reasoning. This outcome will be assessed and scored by problem 11 from Chapter 7 Exam, problem 16 from Chapter 8 Exam, problems 6 and 10 from Chapter 9 Exam, and problem 1 from Chapter 10 Exam.

Outcome D: Upon successful completion of this course 70% of the students should be able to choose and apply appropriate statistical techniques to real world data problems.
This outcome will be assessed and scored by problem 13 from Chapter 6 Exam, problem 12 from Chapter 7 Exam, problem 14 from Chapter 8 Exam, problem 9 from Chapter 9 Exam, and problem 10 from Chapter 10 Exam.

Plans for Improvement and Reassessment

A synopsis of the e-mail trail of Departmental discussion follows.

Outcome B
Upon successful completion of this course 70% of the students should be able to have a basic literacy in the areas of probability and statistics.
1. Describe the population and sample in an experiment.

2. Draw a tree diagram for a probability experiment.
3. Demonstrate the concept of mutually exclusive using a Venn Diagram.
4. Explain the concept "independent".
5. Define the random variable, sampling distribution, hypothesis test, null hypothesis, and p-value.
6. Use normal, binomial, t, chi-square, and F-test tables.
7. Describe what it means to reject the null hypothesis.

Outcome C

Upon successful completion of this course 70% of the students should be able to follow and evaluate a statistical line
of reasoning.

1. Demonstrate in a stepwise approach the process of hypothesis testing.
2. Explain how to solve a probability question starting with the determination of the sample space.
3. Explain the steps to find confidence intervals and then why they are important.
4. Describe why and how the normal, binomial, t, chi square, and F-test tables are used.
5. Draw and shade the rejection region by first finding the appropriate z,t, chi-square score, or F-test score

Outcome D

Upon successful completion of this course 70% of the students should be able to choose and apply appropriate
statistical techniques to real world data problems

1. Determine which hypothesis test should be used in a given question.
2. Determine the test needed to find the confidence interval.
3. Write a real world hypothesis test question with appropriate given information.
4. Explain when to use odds and when to use probability.

B.

- test or quiz students on basic definitions to encourage them to learn the concepts. I ask students to make flash cards and use them but this may prove difficult as K-12 schools (41 states to date) seem to be eliminating cursive writing from the curriculum. Students, for example, tend to have a hard time distinguishing between a SRS and RS.
- I don't take them to Vegas but I did purchase a Roulette wheel and we play roulette for a while while discussing strategies, probabilities, and expected winnings. I also have a lottery machine that I use in class; a good place to discuss the difference between 0 and 0+ probabilities. I also use cards and a variety of dice; e.g., I recently purchase some spherical dice that gives new meaning to "rolling the dice." Gizmos that help attract attention for those with a short attention span.

C.

- Encourage students to "draw the picture" and shade in the appropriate area to help reinforce the concept and help associate the visual to the number they are getting. I have a normal curve template and show this to students as a means to encourage them to draw helpful pictures & diagrams.

D.1 - that is a tough one as well. Here. I have used labs as well. I have students measure something such as weights. I have a bucket of small plastic fish that I use for tag and recapture

problems in algebra. I have students weigh fish or pennies, first individually and then as the mean of samples to help show the difference.
D.2 - group work on the board is a good staple.

Outcome B - students should be able to have a basic literacy in the areas of probability and statistics.
1. Define the word inclusive so that students see the difference between a small probability and one that is zero.
2. Emphasize the definition of probability, especially the denominator part.
3. Draw tree diagrams for probabilities involving multiple trials to emphasize the multiplication rule.
4. Present more examples of contingency tables in class so that errors are not made in interpreting them.
5. For the concept of odds, arrange a field trip to Vegas. LOL
Outcome C - Students should be able to follow and evaluate a statistical line of reasoning.
1. Encourage students to use and learn the flow charts on pages 400 and 403 when working hypothesis test problems. The chart on page 403, fig. 8-7 is especially useful in helping with the wording of final conclusions. Differentiate between terms such as "support" and "fail to reject". It might be helpful to use the wording "don't reject" in place of "fail to reject."
2. Show students the connection between confidence intervals, p-values and the test statistic. Encourage them to check that the different methods agree and support the same outcome.
Outcome D - the students should be able to choose and apply appropriate statistical techniques to real world data problems.
1. Distinguish between finding the probability for a single randomly selected person versus finding the probability for the mean of a group of persons.
2. Have students work applications collaboratively in class following a step by step procedure. Each group is given an application where they discuss and decide on the null/alternative hypotheses, test statistic, p-value and conclusion. One group representative then records on the board in front of the class. Hopefully the repetition will reinforce the procedure for hypothesis testing.

Math C121H: No SLOs have been assessed.

Math C130: This course has nine SLOs. The mathematics department decided that any outcome with a success rate ranging between 65% and 69% merited close departmental scrutiny, and those below 65% merited a plan for improvement and reassessment. The following SLOs had success rates of less that 65%:

Outcome A: 52%
Outcome C: 59%
Outcome G: 63%

<u>Outcome Assessments and Definitions</u>
Outcome A: Upon successful completion of this course 70% of the students should be able to develop mathematical models and employ linear curve fitting techniques. This outcome will be assessed and scored by problems 17 through 22 from Chapter 1 Exam.

Outcome C: Upon successful completion of this course 70% of the students should be able to use both geometric and simplex methods of linear programming to solve optimization problems with two or more variables. This outcome will be assessed and scored by Chapter 3 Exam and Chapter 4 Exam.

Outcome G: Upon successful completion of this course 70% of the students should be able to summarize and analyze data sets and apply statistical models to them. This outcome will be assessed and scored by problems 20 through 22 from Chapter 1 Exam, and the entire Chapter 9 Exam.

Plans for Improvement and Reassessment

A synopsis of the e-mail trail of Departmental discussion follows.

Definition: Outcome A
Upon successful completion of this course 70% of the students should be able to develop mathematical models and employ linear curve fitting techniques. This outcome will be assessed and scored by problems 17 through 22 from Chapter 1 Exam.
a. Present a "big picture" explanation using a scatter diagram with several lines drawn through it, and ask which line best fits the points in the diagram.
b. Explain the "Least Squares" approach to curve fitting, first graphically, then algebraically.
Definition: Outcome C
Upon successful completion of this course 70% of the students should be able to use both geometric and simplex methods of linear programming to solve optimization problems with two or more variables. This outcome will be assessed and scored by Chapter Exam 3 and Chapter Exam 4.
a. Here's another one where pictures help. Tie together the concepts of evaluating the objective function at corner points with the Simplex Method process. Demonstrate that the first process occurs in two dimensions, whereas the second occurs in at least two.
Definition: Outcome G
Upon successful completion of this course 70% of the students should be able to summarize and analyze data sets and apply statistical models to them. This outcome will be assessed and scored by problems 20 through 22 from Chapter 1 Exam, and the entire Chapter 9 Exam.
a. Instruct students in how to conduct non-linear regression using either their graphing calculators, (I recommend that they obtain either a TI83 or TI84) or Excel.

I like the "Tell them to read the book and ask lots of questions." I also find that many students in this class don't seem to have a very good grasp on the material from the prerequisite course - MC055.
I'm leaning more to going back to "tactile models" in class; sometimes this is kids stuff, sometimes it works & sometimes not but it does seem to keep students entertained.
A. This is a good one for doing experiments such as getting data from scale model trains. roller coasters, and assortments of springs; algal or bacterial growth in a petri dish for logistic curve data gathering is also good and maybe helps relate the stuff to biology classes.
C. A "tactile" suggestion - perhaps construct an actual 3-d graph using KNEX, Lego, or even better Zome Tool pieces; alternately some cardboard and string. Perhaps if they can see the

"region" it may help students understand the process. Of course, there is a limit of three variables to this exercise but it is a start.
G. This relates to A in terms of data gathering. I would also suggest that students try to draw their best graph "by hand" and see how it compares to the technological solution. I do this with linear models often but have not done it very much with other models.
The most important of all the suggestions is: (1) "Tell them to read the book and ask lots of questions." I would add (2) "attend class on a regular basis."

Math C131: This course has seven SLOs. The mathematics department decided that any outcome with a success rate ranging between 65% and 69% merited close departmental scrutiny, and those below 65% merited a plan for improvement and reassessment. No SLOs fell below 65%; however, Outcome E had a 68% success rate and Outcome G had a 65% success rate.

Math C141: This course has nine SLOs. The mathematics department decided that any outcome with a success rate ranging between 65% and 69% merited close departmental scrutiny, and those below 65% merited a plan for improvement and reassessment. Outcome E had a success rate of 62%. It was the only outcome with a less than 65% success rate. No plan for improvement or reassessment has yet been formulated.

Math C142: This course has nine SLOs. The mathematics department decided that any outcome with a success rate ranging between 65% and 69% merited close departmental scrutiny, and those below 65% merited a plan for improvement and reassessment. Outcomes D, F, and G had success rates of 69%, 66%, and 67%, respectively. Outcome H had a success rate of 58%, and Outcome I had a 44% success rate. No plans for improvement or reassessment have yet been formulated for these two outcomes.

Math C151: This course has eight SLOs. The mathematics department decided that any outcome with a success rate ranging between 65% and 69% merited close departmental scrutiny, and those below 65% merited a plan for improvement and reassessment. No SLOs fell below 65%; however, Outcome B had a 69% success rate and Outcome F had a 67% success rate.

Math C152: This course has eight SLOs. The mathematics department decided that any outcome with a success rate ranging between 65% and 69% merited close departmental scrutiny, and those below 65% merited a plan for improvement and reassessment. No SLOs fell below 65%; however, Outcome D had a 68% success rate.

Math C251: This course has five SLOs. The mathematics department decided that any outcome with a success rate ranging between 65% and 69% merited close departmental scrutiny, and those below 65% merited a plan for improvement and reassessment.

Outcome C: 58%

Outcome Assessments and Definitions
Outcome C: Upon successful completion of this course 70% of the students should be able to use vector-valued functions to describe motion in space. This will be assessed by problems 5 and 16 from Chapter 13 Exam.

Plans for Improvement and Reassessment
Departmental discussion suggests that more time during the semester is devoted to this chapter, and less time to the differential equations chapter; the rationale being that differential equations is offered as its own class.

Math C255: This course has nine SLOs. The mathematics department decided that any outcome with a success rate ranging between 65% and 69% merited close departmental scrutiny, and those below 65% merited a plan for improvement and reassessment. Outcome E had a 65% success rate.

Outcome A: 52.5%
Outcome I: 52%

Outcome Assessments and Definitions
Outcome A: Upon successful completion of this course 70% of the students will be able to define and identify differential equations, distinguishing between forms and methods of solution (separable, exact, linear, substitution, and modeling). This will be assessed by an exam question.

Outcome I: Upon successful completion of this course 70% of the students will be able to perform computations and graphical interpretations using computational and mathematical software. This will be assessed by an exam question.

Plans for Improvement and Reassessment
For Outcome A, this subject is introduced at the very end of the first quarter of the semester. Introducing it at the beginning of the second quarter of the semester may give students more time to digest this rather complicated material, before being tested on it.
For Outcome I, students have trouble obtaining eigenvalues because of weak factoring skills. Without correct eigenvalues, obtaining correct eigenvectors is impossible. Lacking these two pieces of information, it is difficult to determine the correct graphical solutions. A rigorous review of trinomial factorization is called for.

Math C257: This course has four SLOs. No outcomes had success rates less than 70%