

CENTRAL NEW MEXICO COMMUNITY COLLEGE
ASSESSMENT REPORT
Due to SAAC by October 15

PART 1: CONTACT & PROGRAM IDENTIFICATION

Report Year and Contact Information:			
<u>2015/16</u> Academic Year	<u>David Heddens</u> Contact Person	<u>dheddens@cnm.edu</u> Email	<u>224-4000 x50267</u> Phone Number

Subject of this Assessment Report:		
Program: _____ <input type="checkbox"/> Certificate <input type="checkbox"/> AA <input type="checkbox"/> AS <input type="checkbox"/> AAS	Gen Ed Area: <u>Mathematics</u> Applicable to: <input checked="" type="checkbox"/> AA/AS <input checked="" type="checkbox"/> AAS	Discipline Area: _____

PART 2: EVIDENCE OF OVERALL PROGRAM EFFECTIVENESS

Summary of Program Successes:
<p>Performance on the five mathematics General Education SLOs arguably dipped slightly from AY2014/15 to AY2015/16, but only with regard to MATH 1315 College Algebra, as MATH 1330 Probability and Statistics performance remained strong. In total, there were ten assessed questions: four associated with MATH 1315 and six associated with MATH 1330. Each of the ten questions targeted a course-level SLO – component. That is, the math department defined four course-level SLOs in 1315 and six course-level SLOs in 1330. For a given course, each course-level SLO had nested within it from four to seven components. While the same course-level SLOs are assessed year after year for MATH 1315, this is not the case for MATH 1330. Even with the same course-level SLOs being assessed, the fact that a different component gets assessed each year presents a kindred but different assessment picture. Hence the dip in SLO performance in 1315.</p> <p>Despite the dip in MATH 1315 for AY2015/16, the math department overall has high performance in General Education Mathematics assessed SLOs. When the assessed SLOs are viewed in aggregate, eight of the ten SLOs are at or above benchmark performance levels.</p>

Description and Evaluation of Recent Changes Made in Support of Student Learning:
<p>The math department opted to repeat, verbatim, the assessed course-level SLOs and components for AY2016/17, with a desire for continuity of assessed outcomes. The identical assessment questions will be implemented again in both MATH 1315 and MATH 1330. The motivation for this, in part, is due to changes in textbook and online homework platform software implementations. To a lesser degree, the state reviewing and likely substantially revising the General Education SLOs favored minimal revisions to pedagogy until after the new SLOs are agreed upon.</p>

PART 3: REPORT ON RECENT ASSESSMENT OF STUDENT LEARNING

Student Learning Outcome(s) Assessed: <i>To add rows: right –click in cell below and select “Insert,” “Insert Rows Above”</i>	Classes/Cohorts Assessed:
1. Solve various kinds of equations, simplify expressions, and apply formulas.	MATH 1315, MATH 1330
2. Demonstrate computational skills with and without the use of technology.	MATH 1315, MATH 1330
3. Generate and interpret a variety of graphs and/or data sets.	MATH 1315, MATH 1330
4. Demonstrate problem solving skills within the context of mathematical applications.	MATH 1315, MATH 1330
5. Demonstrate ability to write mathematical explanations using appropriate definitions and symbols.	MATH 1315, MATH 1330

Measurement Tool(s) Used: <i>To add rows: right –click in cell below and select “Insert,” “Insert Rows Above”</i>	<i>Enter X's for type of tool</i>				Initial Achievement Target or Expectation:
	Internal	External	Direct	Indirect	
Standard Test Questions	X		X		Average score of 2.0 on rubric whole number scale {0, 1, 2, 3}

Assessment Findings:
<p>CNM Gen Ed Mathematics SLO#1 – MATH 1315 College Algebra – Standard Test Question 1</p> <p><i>Course-Level SLO and Component #1b: Solve linear, rational, absolute value, exponential, logarithmic and radical equations using inverse operations including properties of powers, roots, exponents, or logarithms and/or other arithmetic operations as indicated.</i></p> <p>1. Solve the following equation and express your final answer in exact form or round your answer to 4 decimal places.</p> $\log(9 - 4x) = 2.5$

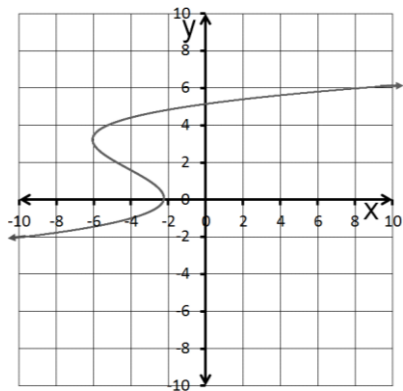
Numerical Assessment Problem #1	0	1	2	3
Answer	Not answered or non-mathematical 'attempt'	Mathematical attempt but major conceptual or calculational error	Mathematical attempt with minor conceptual or calculational error	$x = \frac{9 - 10^{2.5}}{4}$ or $x \approx -76.8069$

MATH 1315 Fall and Spring mean rubric scores were 1.92 and 1.90, respectively.

CNM Gen Ed Mathematics SLO#5 – MATH 1315 College Algebra – Standard Test Question 2

Course-Level SLO and Component 2b: Determine if a relation is, or is not, a function given an equation, graph, and/or a set of ordered pairs.

2. Does the graph below represent a function? How do you know?



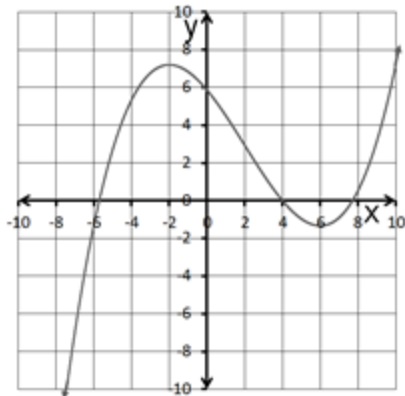
Numerical Assessment Problem #1	0	1	2	3
Answer	Not answered	Neither answer is correct	One of the answers is correct	Both answers are correct

MATH 1315 Fall and Spring mean rubric scores were 2.54 and 2.61, respectively.

CNM Gen Ed Mathematics SLO#3 – MATH 1315 College Algebra – Standard Test Question 3

Course-Level SLO and Component 3b: Determine other key features of a function from its graph such as its domain, range, intervals where it is increasing, decreasing, or constant as well as any extrema.

3. Determine the intervals where the function is increasing. Write your answers in interval notation.



Note to instructors:

For students to receive a 3 in the rubric below, a union symbol in their answer is not necessary; also, ignore use of brackets vs. parentheses – except no brackets around infinity

Numerical Assessment Problem #1	0	1	2	3
Answer	Not answered or non-mathematical 'attempt'	Mathematical attempt but major conceptual or calculational error	Mathematical attempt with minor conceptual or calculational error	$(-\infty, -2)$ $\cup (6, \infty)$

MATH 1315 Fall and Spring mean rubric scores were 2.02 and 2.06, respectively.

CNM Gen Ed Mathematics SLO#2 and SLO#4 – MATH 1315 College Algebra – Standard Test Question 4

Course-Level SLO and Component 4d: Interpret the results of applications problems in terms of their real world context.

4. The total cost $C(x)$, in dollars, of producing x laminated survey maps is

$$C(x) = 0.06x^2 - 0.96x + 14.$$

Determine the vertex and interpret its meaning in the context of this problem.

Numerical Assessment Problem #1	0	1	2	3
Answer	Not answered	Neither answer is correct	One of the answers is correct	Both answers are correct (8,10.16) The minimum cost of \$10.16 occurs when producing 8 maps.

MATH 1315 Fall and Spring mean rubric scores were 1.64 and 1.69, respectively.

CNM Gen Ed Mathematics – MATH 1330 Introduction to Probability and Statistics – Standard Test Question 1

Course-Level SLO and Component 2-3: Calculate and interpret the mean, median, and mode to describe data.

1. The number of home runs that Hank Aaron hit during the years 1956 to 1970 are listed below in chronological order.

26 44 30 39 40 34 45 44 24 32 44 39 29 44 38

a. Find the *mean* of the data. Round your answer to one decimal place, including units of measurement.

Numerical Assessment Problem #1a	0	1	2	3
Answer	Not answered or non-mathematical 'attempt'	Mathematical attempt but major conceptual or calculational error	Mathematical attempt with minor conceptual or calculational error	$\bar{x} = 36.8 \text{ homeruns}$

MATH 1330 Fall and Spring mean rubric scores were 3.00 and 2.71, respectively.

b. Find the *median* of the data, including units of measurement.

Numerical Assessment Problem #1b	0	1	2	3
Answer	Not answered or non-mathematical 'attempt'	Mathematical attempt but major conceptual or calculational error	Mathematical attempt with minor conceptual or calculational error	<i>Median = 39 homeruns</i>

MATH 1330 Fall and Spring mean rubric scores were 2.94 and 2.70, respectively.

c. Find the *mode* of the data, including units of measurement.

Numerical Assessment Problem #1c	0	1	2	3
Answer	Not answered or non-mathematical 'attempt'	Mathematical attempt but major conceptual or calculational error	Mathematical attempt with minor conceptual or calculational error	<i>Mode = 44 homeruns</i>

MATH 1330 Fall and Spring mean rubric scores were 2.88 and 2.66, respectively.

CNM Gen Ed Mathematics – MATH 1330 Introduction to Probability and Statistics – Standard Test Question 2

Course-Level SLO and Component 3-2: Calculate the linear correlation coefficient and use this to decide whether a linear relationship exists between two variables.

Course-Level SLO and Component 3-3: Find the equation of a least-squares regression line between two variables.

2. The table below provides data on five used cars, reporting year of manufacture as years since 2000 and miles driven in thousands.

Year of Manufacture (x)	5	8	10	12	13
Miles Driven (in 1000's) (y)	132	71	88	30	45

a) Calculate the linear correlation coefficient and use this to decide whether a linear relationship exists between the two variables.

Numerical Assessment Problem #2a	0	1	2	3
Answer	Not answered or non-mathematical 'attempt'	Mathematical attempt but major conceptual or calculational error	Mathematical attempt with minor conceptual or calculational error	$r = -0.901$ The variables have a linear relationship and are strongly negatively correlated

MATH 1330 Fall and Spring mean rubric scores were 1.99 and 2.02, respectively.

b) Determine the equation of the regression line (commonly referred to as the least squares line).

Numerical Assessment Problem #2b	0	1	2	3
Answer	Not answered or non-mathematical 'attempt'	Mathematical attempt but major conceptual or calculational error	Mathematical attempt with minor conceptual or calculational error	$y = -11.2x + 180.5$

MATH 1330 Fall and Spring mean rubric scores were 2.63 and 2.15, respectively.

CNM Gen Ed Mathematics – MATH 1330 Introduction to Probability and Statistics – Standard Test Question 3

Course-Level SLO and Component 4-5: Calculate probabilities using the standard normal distribution

- Medical studies have shown that a person's blood glucose (in milligrams per deciliter, mg/dL), after fasting 12 hours, is approximately normal with a mean of 85 mg/dL and a standard deviation of 25 mg/dL. Find the probability that a randomly selected person will have a blood glucose level greater than 100 mg/dL. Round your answer to three decimal places.

Numerical Assessment Problem #3	0	1	2	3
Answer	Not answered or non-mathematical 'attempt'	Mathematical attempt but major conceptual or calculational error	Mathematical attempt with minor conceptual or calculational error	$P\left(X > \frac{100mg}{dL}\right) = 0.274$

MATH 1330 Fall and Spring mean rubric scores were 2.32 and 1.82, respectively.

Analysis and Interpretation of Assessment Findings:

During AY2015/2016, 1096 students were assessed in MATH 1315 College Algebra, with 595 and 501 students arising from the Fall and Spring semesters, respectively. Students were assessed overwhelmingly during the final exam (Fall 91%, Spring 100%) as opposed to over a series of midterms. Students also overwhelmingly were permitted calculator usage on the assessment questions (Fall 90%, Spring 100%). A slim majority of students were not permitted notes usage of any variety during assessment (Fall 58%, Spring 67%).

SLO#1 and SLO#4 exhibited weakness in failing to meet the benchmark of 2.00, in contrast to AY2014/2015 in which performance across all four College Algebra Course-Level SLO's, and hence all five CNM Gen Ed Math SLO's, was strong. Only 8 out of the 16 mean rubric scores exceeded the benchmark of 2.00, as summarized in Table 1 below.

Table 1. MATH 1315 College Algebra mean rubric scores of assessment questions AY2015-2016 by Course-Level SLO and Component.

SLO#1: Use and solve various kinds of equations and formulas		Fall	Spring
b) Solve linear, rational, absolute value, exponential, logarithmic and radical equations using inverse operations including properties of powers, roots, exponents, logarithms and/or other arithmetic operations as indicated	Q1	1.92	1.90
SLO#2: Write mathematical explanations using appropriate definitions and symbols		Fall	Spring
b) Determine if a relation is, or is not, a function given an equation, graph, and/or a set of ordered pairs.	Q2	2.54	2.61
SLO#3: Construct and analyze graphs and/or data sets algebraically		Fall	Spring
b) Determine other key features of a function from its graph such as its domain, range, intervals where it is increasing, decreasing or constant as well as any extrema	Q3	2.02	2.06

SLO#4: Utilize appropriate problem solving skills within the context of mathematical applications		Fall	Spring
d) Interpret the results of applications problems in terms of their real world context	Q4	1.64	1.69

During AY2015/2016, 422 students were assessed in MATH 1330 Introduction to Probability and Statistics, with 68 and 354 students arising from the Fall and Spring semesters, respectively. Students being permitted to use notes during assessment varied widely (Fall 100%, Spring 74%). All students were permitted the use of a calculator, with graphing calculator use dominating over scientific calculator use (Fall 100%, Spring 83%).

Performance across Introduction to Probability and Statistics Course-Level student learning outcomes SLO#2, SLO #3, and SLO#4 was strong AY2015/2016, as it was also during AY2014/2015. Ten out of the 12 mean rubric scores exceeded the benchmark of 2.00, as summarized in Table 2 below.

Table 2. MATH 1330 Introduction to Probability and Statistics mean rubric scores of assessment questions AY2015-2016 by Course-Level SLO and Component.

SLO#2: Presentation and description of data		Fall	Spring
	Q1a	3.00	2.71
3) Calculate and interpret the mean, median, and mode to describe data	Q1b	2.94	2.70
	Q1c	2.88	2.66
SLO#3: Analyze data using regression and correlation		Fall	Spring
2) Calculate the linear correlation coefficient and use this to decide whether a linear relationship exists between two variables	Q2a	1.99	2.02
	Q2b	2.63	2.15
3) Find the least-squares regression line between two variables			
SLO#4: Present the concepts of probability distributions		Fall	Spring
5) Calculate probabilities using the standard normal distribution	Q3	2.32	1.82

Action Plan in Support of Student Learning:

Although no clear deficiencies in student learning in MATH 1315 College Algebra were identifiable during AY2014/15, it appears that SLO#1 and SLO#4 were weak during AY2015/16. While addressing performance at solving logarithmic equations lends itself to rather straight-forward methods, the skill of solving applications problems is more comprehensive and diffuse in nature. In contrast, MATH 1330 Introduction to Probability and Statistics performance remained high for a second consecutive year during AY2015/16. The math department decided to assess the exact same SLOs using the exact same questions for AY2016/17 to if there truly is recurring weakness in MATH 1315 or if AY2015/16 was an anomaly.

Recommendations, Proposals, and/or Funding Requests:**PART 4: EMBEDDED OUTCOMES****Critical Thinking and Life Skills/Teamwork Development within Programs:**

- a) Please describe how Critical Thinking assessment is embedded within your program assessment.
- b) Please describe how Life Skills/Teamwork assessment is embedded within your program assessment.

a)

b)

PART 5: ASSESSMENT CYCLE PLAN (Copy and paste from original plan if unchanged)

Cycle Years:	Plan Description:
AY2014/18	Each year all five General Education Mathematics SLOs will be assessed using standard test questions that are internal and direct. For analysis and reporting convenience, MATH 1315 College Algebra course-level SLOs are listed below and a crosswalk between the course-level and General Education Mathematics SLOs is appended. Note that MATH 1315 has four course-level SLOs, each comprised of from two to five components. These components within the course-level SLO will be cycled over the years so that ultimately each component itself gets assessed.
AY2011/15	To enable staggered cycle-plan renewals among the Math AS Degree, Gen Ed MATH 1315, and Gen Ed MATH 1330 assessment efforts, the remaining two years of the cycle-plan, AY2014/15 and AY2015/16, will likely be completed for MATH 1330 before renewal. For analysis and reporting convenience, MATH 1330 Introduction to Probability and Statistics course-level SLOs are listed below and a crosswalk between the course-level and General Education Mathematics SLOs is appended. Note that MATH 1330 has six course-level SLOs, each comprised of from three to seven components. These components within the course-level SLO will be cycled over the years so that ultimately each component itself gets assessed. Please see the crosswalk for years prior to AY2013/14.

Student Learning Outcomes*:	When Measured:	Where Measured:	How Measured:
1. Use and solve various kinds of equations and formulas.	AY2014/15 through AY2018/19	MATH 1315	Standard Test Questions: internal and direct. (component cycling a-b-c-d)
2. Write mathematical explanations using appropriate definitions and symbols.	AY2014/15 through AY2018/19	MATH 1315	Standard Test Questions: internal and direct. (component cycling a-b-e-c-d)
3. Construct and analyze graphs and/or data sets algebraically.	AY2014/15 through AY2018/19	MATH 1315	Standard Test Questions: internal and direct. (component cycling b-b-a-a)
4. Utilize appropriate problem solving skills within the context of mathematical applications.	AY2014/15 through AY2018/19	MATH 1315	Standard Test Questions: internal and direct. (component cycling c-d-a-b)
5. Explain the general concepts of Statistics.	not assessed this cycle	MATH 1330	Standard Test Questions: internal and direct.
6. Presentation and Description of data.	AY2014/15 AY2015/16	MATH 1330	Standard Test Questions: internal and direct.
7. Analyze data using regression and correlation.	AY2014/15 AY2015/16	MATH 1330	Standard Test Questions: internal and direct.
8. Present the concepts of probability distributions	AY2013/14 AY2014/15 AY2015/16	MATH 1330	Standard Test Questions: internal and direct.
9. Compute point and interval estimates.	not assessed this cycle	MATH 1330	Standard Test Questions: internal and direct.
10. Perform hypothesis tests.	not assessed this cycle	MATH 1330	Standard Test Questions: internal and direct.

* These are the four course-level SLOs of MATH 1315 and the six course-level SLOs of MATH 1330.

Addendum: Crosswalk between General Education Mathematics SLOs and MATH 1315 Course-Level SLOs

Course-Level SLO Gen Ed SLO	1. Use and solve various kinds of equations and formulas.	2. Write mathematical explanations using appropriate definitions and symbols.	3. Construct and analyze graphs and/or data sets algebraically.	4. Utilize appropriate problem solving skills within the context of mathematical applications.
1. Solve various kinds of equations, simplify expressions, and apply formulas.	X			
2. Demonstrate computational skills with and without the use of technology.	X			X
3. Generate and interpret a variety of graphs and/or data sets.			X	
4. Demonstrate problem solving skills within the context of mathematical applications.				X
5. Demonstrate ability to write mathematical explanations using appropriate definitions and symbols.		X		

Addendum: Crosswalk between General Education Mathematics SLOs and MATH 1330 Course-Level SLOs

Course-Level SLO Gen Ed SLO*	1. Explain the general concepts of Statistics.	2. Presentation and description of data.	3. Analyze data using regression and correlation.	4. Present the concepts of probability distributions.	5. Compute point and interval estimates.	6. Perform hypothesis tests.
1. Solve various kinds of equations, simplify expressions, and apply formulas.		X	X	X	X	X
2. Demonstrate computational skills with and without the use of technology.		X	X	X	X	X
3. Generate and interpret a variety of graphs and/or data sets.		X	X	X		
4. Demonstrate problem solving skills within the context of mathematical applications.		X	X	X	X	X
5. Demonstrate ability to write mathematical explanations using appropriate definitions and symbols.	X		X	X	X	X

*Prior to AY2013/14, Gen Ed SLOs were assessed without mapping to Course-Level SLOs. Assessed Gen Ed SLO years are as follows:
SLO#1 – AY2011/12; SLO#2 AY2012/13; SLO#3 AY2011/12; SLO#4 AY2012/13; SLO#5 not assessed prior to AY2013/14