

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

**PART 1: CONTACT & PROGRAM IDENTIFICATION**

Report Year and Contact Information			
<u>2016/17</u> <b>Academic Year</b>	<u>David Heddens</u> <b>Contact Person</b>	<u>dheddens@cnm.edu</u> <b>Email</b>	<u>224-4000 x50267</u> <b>Phone Number</b>

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

**PART 2: THE YEAR IN RETROSPECT**

Program/Area Highlights (Including, wherever applicable, course completion, job placement, and licensing examination information)
<p>Students continued to perform well in General Education Mathematics during Academic Year 2016/17 as evinced by the assessment data. A large majority of mean rubric scores across the Gen. Ed. Math curriculum exceeded the 2.00 benchmark. These results occurred despite the contentious challenges of textbook changes and varieties of homework platform software implementations. Due to the department opting to collect two year longitudinal data via the repeated implementation of assessment tools verbatim, a weakness within College Algebra was identified and will now be addressed during Academic Year 2017/18.</p>

Changes Made in Support of Student Learning
<p>Per the strategies devised during the last academic year (AY2015/16), the department adopted no changes in pedagogy in favor of obtaining longitudinal data and so subsequently uncovering a weakness within College Algebra during the AY2016/17 assessment year.</p>

**PART 3: REPORT ON RECENT ASSESSMENT OF STUDENT LEARNING**

Student Learning Outcome(s) Assessed <small>To add rows: right-click in cell below and select "Insert," "Insert Rows Above"</small>	Classes/Cohorts Assessed
1. Solve various kinds of equations, simplify expressions, and apply formulas	MATH 1315, MATH 1320, MATH 1330

2. Demonstrate computational skills with and without the use of technology.	MATH 1315, MATH 1320, MATH 1330
3. Generate and interpret a variety of graphs and/or data sets.	MATH 1315, MATH 1320, MATH 1330
4. Demonstrate problem solving skills within the context of mathematical applications.	MATH 1315, MATH 1320, MATH 1330
5. Demonstrate ability to write mathematical explanations using appropriate definitions and symbols.	MATH 1315, MATH 1320, MATH 1330

Measurement Tool(s) Used <i>To add rows: right-click in cell below and select "Insert," "Insert Rows Above"</i>	Enter X's for type of tool				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}
Custom Assessment Questions per Instructor's Prerogative	X		X		Average score of 2.0 on rubric whole number scale {0, 1, 2, 3}

Assessment Findings
<p><b>CNM Gen Ed Mathematics SLO#1 – MATH 1315 College Algebra – Standard Test Question 1</b></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> $\log(9 - 4x) = 2.5$

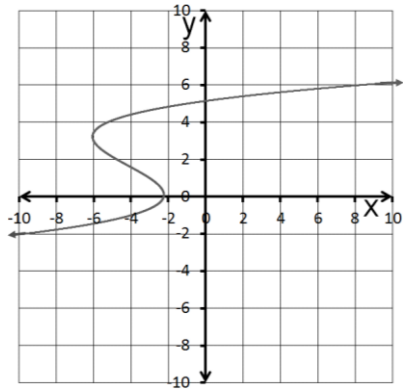
Numerical Assessment Problem #1	0	1	2	3
Answer	Not answered or non-mathematical 'attempt'	Mathematical attempt but major conceptual or calculational error	Mathematical attempt with minor conceptual or calculational error	$x = \frac{9 - 10^{25}}{4}$ or $x \approx -76.8069$

MATH 1315 Fall and Spring mean rubric scores were 1.79 (n=533) and 1.80 (n=391), 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?



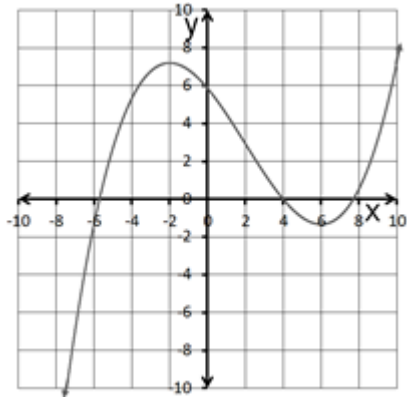
Numerical Assessment Problem #2	0	1	2	3
Answer	Not answered	Neither answer is correct	One of the answers is correct	Both answers are correct

MATH 1315 Fall and Spring mean rubric scores were 2.56 (n=533) and 2.61 (n=391), 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 #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	$(-\infty, -2) \cup (6, \infty)$

MATH 1315 Fall and Spring mean rubric scores were 2.24 (n=533) and 2.09 (n=391), 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 #4	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 1.72 (n=533) and 1.66 (3.91), 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	$\bar{x} = 36.8 \text{ homeruns}$

The MATH 1330 Spring mean rubric score was 2.69 (n=576).

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>

The MATH 1330 Spring mean rubric score was 2.50 (n=576).

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>

The MATH 1330 Spring mean rubric score was 2.63 (n=576).

**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

The MATH 1330 Spring mean rubric score was 1.84 (n=523).

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	$y = -11.2x + 180.5$

The MATH 1330 Spring mean rubric score was 2.07 (n=518).

### 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	$P\left(X > \frac{100mg}{dL}\right) = 0.274$

The MATH 1330 Spring mean rubric score was 1.95 (n=574).

**CNM Gen Ed Mathematics – MATH 1320 Survey of Mathematics – Custom Assessment Questions per Instructor’s Prerogative**

*Course-Level SLO#1 Construct and analyze graphical representations: Competency 1 Gather and organize information*

MATH 1320 Fall and Spring mean rubric scores were 2.93 (n=57) and 2.10 (n=45), respectively.

**CNM Gen Ed Mathematics – MATH 1320 Survey of Mathematics – Custom Assessment Questions per Instructor’s Prerogative**

*Course-Level SLO#1 Construct and analyze graphical representations: Competency 2 Understand the purpose and use of various graphical representations such as tables, line graphs, tilings, networks, bar graphs, etc.*

MATH 1320 Fall and Spring mean rubric scores were 2.88 (n=57) and 2.31 (n=45), respectively.

**CNM Gen Ed Mathematics – MATH 1320 Survey of Mathematics – Custom Assessment Questions per Instructor’s Prerogative**

*Course-Level SLO#1 Construct and analyze graphical representations: Competency 3 Interpret results through graphs, lists, tables, sequences, etc.*

MATH 1320 Fall and Spring mean rubric scores were 2.86 (n=57) and 2.17 (n=45), respectively.

**CNM Gen Ed Mathematics – MATH 1320 Survey of Mathematics – Custom Assessment Questions per Instructor’s Prerogative**

*Course-Level SLO#1 Construct and analyze graphical representations: Competency 4 Draw conclusions from data or various graphical representations*

MATH 1320 Fall and Spring mean rubric scores were 2.68 (n=57) and 2.03 (n=45), respectively.

**Analysis and Interpretation of Assessment Findings**

During AY2016/2017, 924 students were assessed in MATH 1315 College Algebra, with 533 and 391 students arising from the Fall and Spring semesters, respectively. Students were assessed solely during the final exam (Fall 100%, Spring N/A) as opposed to over a series of midterms. Students overwhelmingly were permitted scientific calculator usage (graphing calculators prohibited by policy) on the assessment questions (Fall 91%, Spring N/A). Per policy, students



were not permitted any variety of notes usage during assessment (Fall 96%, Spring N/A).

With the assessment questions kept verbatim between AY2015/16 and AY2016/17, mean rubric scores appeared similar. A formal statistical analysis would likely yield no statistically significant differences. As with last academic year, this academic year also exhibited weakness in failing to meet the benchmark of 2.00 for Course-Level SLO#1 and Course-Level SLO#4. Further repeating last year's performance, only 4 out of the 8 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 AY2016-2017 by Course-Level SLO and Component.

<b>Course-Level SLO#1: Use and solve various kinds of equations and formulas</b>		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	1.79	1.80
<b>Course-Level SLO#2: Write mathematical explanations using appropriate definitions and symbols</b>		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	2.56	2.61
<b>Course-Level SLO#3: Construct and analyze graphs and/or data sets algebraically</b>		Fall	Spring
b) Determine if a relation is, or is not, a function given an equation, graph, and/or a set of ordered pairs	Q3	2.24	2.09
<b>Course-Level SLO#4: Utilize appropriate problem solving skills within the context of mathematical applications</b>		Fall	Spring
d) Interpret the results of applications problems in terms of their real world context	Q4	1.72	1.66

During AY2016/2017, 576 students were assessed in MATH 1330 Introduction to Probability and Statistics during the Spring semester. Students being permitted to use notes during assessment varied (72%). All students were permitted the use of a calculator, with graphing calculator use dominating over scientific calculator use (94%).

With the assessment questions kept verbatim between AY2015/16 and AY2016/17, performance across Introduction to Probability and Statistics course-level student learning outcomes SLO#2, SLO #3, and SLO#4 was strong again during AY2016/2017, as it was during AY2015/2016. There likely are no statistically significant differences in performance between the two academic years. Four out of the 6 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 AY2016-2017 by Course-Level SLO and Component.

<b>Course-Level SLO#2: Presentation and description of data</b>		Fall	Spring
	Q1a	N/A	2.69
3) Calculate and interpret the mean, median, and mode to describe data	Q1b	N/A	2.50
	Q1c	N/A	2.63
<b>Course-Level SLO#3: Analyze data using regression and correlation</b>		Fall	Spring
2) Calculate the linear correlation coefficient and use this to decide whether a linear relationship exists between two variables	Q2a	N/A	1.84
	Q2b	N/A	2.07
3) Find the least-squares regression line between two variables			
<b>Course-Level SLO#4: Present the concepts of probability distributions</b>		Fall	Spring
5) Calculate probabilities using the standard normal Distribution	Q3	N/A	1.95

Academic year 2016/17 was the inaugural year of analyzing MATH 1320 Survey of Mathematics assessment data. One-hundred two students were assessed, with 57 and 45 students arising from the Fall and Spring semesters, respectively. Due to the varied topics coverage across sections of MATH 1320, faculty custom designed their own assessment questions, and timing and circumstances of administration were at instructors' discretion.

Performance on Course-Level SLO#1 was strong across the board with all 8 out of 8 mean rubric scores exceeding the benchmark of 2.00, as summarized in Table 3 below.

Table 3. MATH 1320 Survey of Mathematics mean rubric scores of Assessment questions AY2016-2017 by Course-Level SLO and Component.

<b>Course-Level SLO#1: Construct and analyze graphical representations</b>		Fall	Spring
1) Gather and organize information	Q1	2.93	2.10
2) Understand the purpose and use of various graphical representations such as tables, line graphs, tilings, networks, bar graphs, etc.	Q2	2.88	2.31
3) Interpret results through graphs, lists, tables, sequences, etc.	Q3	2.86	2.17

4) Draw conclusions from data or various graphical representations	Q4	2.68	2.03
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**Action Plan in Support of Student Learning**

Two academic years in a row MATH 1315 College Algebra has exhibited weakness in Course-Level SLO#1 and Course-Level SLO#4. The department is anticipated to either (a) consider a pedagogical change for the teaching of solving equations and solving applications problems or (b) devote time to developing an integrated approach among faculty in teaching equation solving and applications problems. When General Education Mathematics is inspected holistically across all the courses and SLOs assessed, the math department is performing well with a large majority of mean rubric scores exceeding the benchmark.

*Please indicate with an X all of the following that characterize the types of changes described in the above action plan:*

- Pedagogical change     
 Course revision     
 Process revision     
 Curricular revision  
 Budgetary reallocation     
 Faculty training/development     
 Assessment criteria revision     
 Assessment methodology revision

**Recommendations, Proposals, and/or Funding Requests**

**PART 4: ASSESSMENT CYCLE PLAN UPDATE** (Copy and paste from original plan if unchanged)

Cycle Years	Description of Changes Made (if applicable)
AY2014/18	Each year all five General Education Mathematics SLOs will be assessed using either standard test questions that are internal and direct or custom designed assessment questions that are at instructors' discretion. For analysis and reporting convenience, all assessed course-level SLOs are listed below and crosswalks between the course-level and General Education Mathematics SLOs are appended. Note that for each assessed course, components within the course-level SLOs are cycled over the years so that ultimately each component itself gets assessed.
AY2011/15	To enable staggered cycle-plan renewals between the Math AS Degree and General Education Math assessment efforts, the remaining two years of the cycle-plan, AY2014/15 and AY2015/16, were 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.

<b>Student Learning Outcomes*</b>	<b>When Measured</b>	<b>Where Measured</b>	<b>How Measured</b>
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 AY208/19	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 AY 2018/19	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 through AY2016/17	MATH 1330	Standard Test Questions: internal and direct.
7. Analyze data using regression and correlation.	AY2014/15 through AY2016/17	MATH 1330	Standard Test Questions: internal and direct.
8. Present the concepts of probability distributions	AY2013/15 through AY2016/17	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.
11. Construct and analyze graphical representations.	AY2016/17	MATH 1320	Custom Assessment Questions per Instructor's Prerogative: internal and direct
12. Use patterns to solve new problems.	AY2017/18	MATH 1320	Custom Assessment Questions per Instructor's Prerogative: internal and direct

13. Discover new mathematical ideas through exploration.	pending SLO and SLO-component cycling planning	MATH 1320	Custom Assessment Questions per Instructor's Prerogative: internal and direct
14. Communicate using proper mathematical terminology and notations.	pending SLO and SLO-component cycling planning	MATH 1320	Custom Assessment Questions per Instructor's Prerogative: internal and direct
15. Explain how to apply mathematical ideas.	pending SLO and SLO-component cycling planning	MATH 1320	Custom Assessment Questions per Instructor's Prerogative: internal and direct
16. Solve problems without a standard algorithm.	pending SLO and SLO-component cycling planning	MATH 1320	Custom Assessment Questions per Instructor's Prerogative: internal and direct
17. Describe overarching concepts and their usage in the following areas: a) Probability, Statistics, and Decision Theory b) Geometry c) Graph Theory and/or Operations Research d) Algebra and/or Discrete Math	pending SLO and SLO-component cycling planning	MATH 1320	Custom Assessment Questions per Instructor's Prerogative: internal and direct

\*These are the four course-level SLOs of MATH 1315, the six course-level SLOs of MATH 1330, and the seven course-level SLOs of MATH 1320.

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.	<b>X</b>			
2. Demonstrate computational skills with and without the use of technology.	<b>X</b>			<b>X</b>
3. Generate and interpret a variety of graphs and/or data sets.			<b>X</b>	
4. Demonstrate problem solving skills within the context of mathematical applications.				<b>X</b>
5. Demonstrate ability to write mathematical explanations using appropriate definitions and symbols.		<b>X</b>		

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

Addendum: Crosswalk between General Education Mathematics SLOs and MATH 1320 Course-Level SLOs

Gen Ed SLO Course-Level SLO	1. Construct and analyze graphs and/or data sets.	2. Use and solve various kinds of equations.	3. Understand and write mathematical explanations using appropriate definitions and symbols.	4. Demonstrate problem solving skills within the context of mathematical applications.
1. Construct and analyze graphical representations.	<b>X</b>			
2. Use patterns to solve new problems.				<b>X</b>
3. Discover new mathematical ideas through exploration.	<b>X</b>	<b>X</b>		
4. Communicate using proper mathematical terminology and notations.			<b>X</b>	
5. Explain how to apply mathematical ideas.			<b>X</b>	<b>X</b>
6. Solve problems without a standard algorithm.				<b>X</b>
7. Describe overarching concepts and their usage in the following areas: a) Probability, Statistics, and Decision Theory b) Geometry c) Graph Theory and/or Operations Research d) Algebra and/or Discrete Math			<b>X</b>	