

To: Dr. Neal Bukeavich, Associate Vice President for Academic Affairs & Dean of Arts and Sciences

From: Dr. Weiwei Zhang, Chair of Mathematics and Computer Science Department

Subject: MATH CART Assessment 2018-2019

Date: June 2019

MATH CART

Learning Outcome 1: Representation

Assessment Measures / Methods	Target / Benchmark	Results	Action Taken
<p>Assessment 1 (direct)</p> <p>Projects or problems from the comprehensive final exams in</p> <p style="text-align: center;">CORE 120 MATH 101 MATH 102 MATH 123 MATH 127 MATH 128 MATH 129</p>	<p>At least 80% of students earn a score of 2 or better on a 4-point assessment rubric</p>	<p>Target met in some courses</p> <p>CORE 120: 93% MATH 101: 84% MATH 102: 100% MATH 123: 86% MATH 127: 100%</p> <p>Target not met in some courses</p> <p>MATH 128: 65% MATH 129: 77%</p>	<p>Department plans to reevaluate the maximum section cap for some courses, for example MATH 128.</p> <p>The department plans to review the rubric for the freshmen placement procedure and make sure that students are placed into the most appropriate course.</p>
<p>Assessment 2 (indirect)</p> <p>Course grades in</p> <p style="text-align: center;">CORE 120 MATH 101 MATH 102 MATH 123 MATH 127 MATH 128 MATH 129</p>	<p>At least 80% of students earn a course grades of C- or above</p>	<p>Target met in some courses</p> <p>CORE 120: 90% MATH 101: 95% MATH 102: 92% MATH 123: 82% MATH 128: 84% MATH 129: 80%</p> <p>Target not met in</p> <p>MATH 127: 67%</p>	

MATH CART

Learning Outcome 2: Calculation

Assessment Measures / Methods	Target / Benchmark	Results	Action Taken
<p>Assessment 1 (direct)</p> <p>Projects or problems from the comprehensive final exams in</p> <p style="padding-left: 40px;">CORE 120 MATH 101 MATH 102 MATH 123 MATH 125 MATH 126 MATH 127 MATH 129</p>	<p>At least 80% of students earn a score of 2 or better on a 4-point assessment rubric</p>	<p>Target met in some courses</p> <p style="padding-left: 20px;">CORE 120: 85% MATH 101: 100% MATH 102: 83% MATH 126: 93% MATH 123: 89% MATH 125: 93% MATH 127: 100%</p> <p>Target not met in some courses</p> <p style="padding-left: 20px;">MATH 129: 76%</p>	<p>Department plans to reevaluate the maximum section cap for some courses, for example MATH 123.</p> <p>MATH 123 instructors plan to develop more learning activities and provide more opportunities for students to practice.</p> <p>The department plans to review the rubric for the freshmen placement procedure and make sure that students are placed into the most appropriate course.</p>
<p>Assessment 2 (indirect)</p> <p>Course grades in</p> <p style="padding-left: 40px;">CORE 120 MATH 101 MATH 102 MATH 123 MATH 125 MATH 127 MATH 128 MATH 129</p>	<p>At least 80% of students earn a course grades of C- or above</p>	<p>Target met in some courses</p> <p style="padding-left: 20px;">MATH 101: 92% MATH 102: 83% MATH 126: 87% MATH 125: 86% MATH 127: 100% MATH 129: 90%</p> <p>Target not met in some courses</p> <p style="padding-left: 20px;">CORE 120: 76% MATH 123: 76%</p>	

MATH CART

Learning Outcome 2: Calculation

Assessment Measures / Methods	Target / Benchmark	Results	Action Taken
Assessment 3 (direct) Diagnostic pre-test and a diagnostic post-test involving similar content in MATH 100	Target 1 A median post-test score of at least 80%.	Target 2 met in MATH 100 Target 1 not met in MATH 100	Department plans to review the benchmark used for MATH 100 assessment and continue to work on the diagnostic tests to ensure they serve the assessment purpose well.
	Target 2 A 30% increase in median from pre-test to post-test.		

Discussion

- For MATH 100, the diagnostic pre-test and post-test were administered during both semesters. Data was collected for 112 students in Fall 18 and 43 students in Spring 19. Below is a summary of the assessment data collected.

	Fall	Spring
Median of pre-test	23%	13%
Median of post-test	63%	70%
Increment	40%	57%

This is the first academic year in which CORE 098 - Mathematical Skills was replaced by MATH 100 – College Algebra. MATH 100 is a more rigorous college level course that allows students to earn credits toward graduation, different from CORE 098. A student must attain a minimum of a "C-" grade in order to move on to the other math courses, while a C was needed for CORE 098.

Although Target 1 was missed this year, Target 2 were met both in Fall and Spring semester. The department has modified the diagnostic test to ensure they are appropriate for the MATH 100 contents.

2. Although the benchmarks of direct assessment for MATH 129 was missed by 3% (in Fall 18) and 4% (in Spring 19), the benchmarks of the indirect assessment of MATH 129 were met. Therefore, the department does not plan to take any action directly regarding MATH 129.

Appendix A: Assessment Items by Course

Core 120 (Representation)

1. In a group of six people, each person is friends with exactly three others. Draw a graph representing these friendships.
2. Draw a graph with five vertices, each having degree 2.
3. Starting and ending in Scranton, you want to take a round-trip that visits Philadelphia, New York, Pittsburgh, and Boston. The distances (in miles) between these cities is given in the chart below:

[Students were given a chart showing mileages between five cities]

Draw a graph with labeled edges representing the information in this chart.

MATH 123 (Calculation)

1. In a committee with fourteen members, eight of the members are female, and six of the members are male. In how many ways can a subcommittee of four members be chosen if there must be exactly two females on the subcommittee.

2. There are 15 baseball teammates on the King's Baseball team.

The King's Baseball coach must make a roster consisting of nine players to make up a team for an upcoming baseball tournament game. How many different 9 member teams are possible?

3. Find the solution set of the following inequalities. To receive full credit, you must:

(A) Shade on the solution set.

(B) Find ALL vertices of the solution set (include all computations).

$$-3x + y \leq 5$$

$$2x + y \leq 10$$

$$x \geq 0$$

$$y \geq 0$$

MATH 123 (representation)

Suppose you own a pizza shop. You rent space in a building for your shop, and the monthly rent and other fixed costs total \$1,500. It costs \$6.00 to make each pizza. You sell each pizza for \$9.00

Let x denote the number of pizzas you produced and sold last month.

- a.) Determine last month's cost function $C(x)$
- b.) Determine last month's revenue function $R(x)$
- c.) Determine last month's profit function $P(x)$

MATH 125 (calculation)

Find the derivative of each function using derivative rules. Be sure to use correct notation. Final answers do not need to be simplified.

$$g(x) = (6x - 8)^3 \sqrt{4x - 7}$$

MATH 126 (calculation)

1. A researcher wants to know if people on the east coast and people on the west coast spent a different number of days at a beach, on average, last summer. A random sample of 41 people from the west coast spent an average of 8.5 days at a beach last summer with a standard deviation of 2.5 days. A random sample of 45 people from the east coast spent an average of 7.75 days at a beach last summer with a standard deviation of 1.5 days.

Calculate the standardized value of the test statistic (t-score) and the degrees of freedom.

2. A machine is used to dispense soda into 473 ml. plastic bottles.

The amount of soda dispensed into the bottles follows a Normal Distribution with *mean* $\mu = 473 \text{ ml.}$ and *standard deviation* $\sigma = 11 \text{ ml.}$

- a.) Determine the proportion of all bottles containing between 458 ml. to 493 ml. of soda?
- b.) Determine the value of the Interquartile Range (*i. e.* *IQR*)?

3. An income difference between male and female workers is a major social problem in the United States. The problem is also a common interest in Japan. Department of Labor at Tokyo Metropolitan government conjectures that male employees are paid higher than female employees. The department took samples of 18 adult male and 25 adult female randomly, call each gender M and F respectively, to learn the problem. The department gathered the following monthly income information.

Gender	Sample Size	Sample Average (dollars)	Sample Standard Deviation (dollars)
M	18	3,000	100
F	25	2,500	120

After careful computations, the Labor Department to reject H_0 . Unfortunately, it does not describe further details such as a confidence interval. Find an appropriate confidence interval and state a confidence level.

4. Lake Superior is home to over 80 species of fish. A researcher was interested in estimating the average length of all fish living in Lake Superior. He randomly sampled 33 of these fish and found the average length of the sampled 33 fish to be 19.09 inches. The standard deviation of the 33 fish was 2.57 inches. Determine a (2-sided) 90% confidence interval for the value of μ

MATH 127 (representation)

Consider the Axiom System below. Primitive terms: hyena, lion, attack

Axiom 1: There exists at least one lion.

Axiom 2: Each lion attacks at least two hyenas.

Axiom 3: For each hyena, there exists exactly one other hyena not attacked by a common lion.

- (a) Create a consistency model.
- (b) Create an independence model for each axiom.

MATH 127 (calculation)

6. Let $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$ be a universal set. Consider the following subsets of U :

$$A = \{1, 4, 7, 8, 9\}, \quad B = \{1, 3\}, \quad C = \{3, 6, 7, 8, 10\}$$

Find the following sets:

(a) ($\frac{1}{2}$ point) $A \cap C$

(b) ($\frac{1}{2}$ point) A^c

(c) ($\frac{1}{2}$ point) $(B \cup C)^c$

(d) ($\frac{1}{2}$ point) $(A \cup B) \cap C$

(e) ($\frac{1}{2}$ point) $A \times B$

(f) ($\frac{1}{2}$ point) $C \setminus B$

(g) ($\frac{1}{2}$ point) $A \oplus C$

(h) ($\frac{1}{2}$ point) $(A \setminus B) \setminus C$

MATH 129 (calculation)

Rapunzel would like to go see the floating lights. Flynn Ryder has taken her to see them. The lights are rising vertically and Rapunzel is on a boat 3 miles east from where the lights are released. How fast are the lights rising when they are 4 miles high, if their distance from Rapunzel is increasing at a rate of 100 miles per hour? Show your work.

Appendix B: Rubric for CORE Math Assessment Items

	Representation	Calculation	Interpretation	Investigation
4	Skillfully converts relevant information into an insightful mathematical portrayal in a way that contributes to further or deeper understanding.	Calculations attempted are essentially all successful and sufficiently comprehensive to solve the problem. Calculations are also presented elegantly (clearly, concisely, etc.)	Provides accurate explanations of information presented in mathematical forms. Makes appropriate inferences based on that information.	Skillfully and thoughtfully generalizes problems and explicitly and correctly describes how assumptions are linked to conclusions.
3	Competently converts relevant information into an appropriate and desired mathematical portrayal.	Calculations attempted are essentially all successful and sufficiently comprehensive to solve the problem.	Provides accurate explanations of information presented in mathematical forms.	Competently generalizes problems and explicitly describes how assumptions are linked to conclusions.
2	Completes conversion of information but resulting mathematical portrayal is only partially appropriate or accurate.	Calculations attempted are either unsuccessful or represent only a portion of the calculations required to comprehensively solve the problem.	Provides somewhat accurate explanations of information presented in mathematical forms, but occasionally makes minor errors related to computations or units.	Attempts to generalize problems and analyze assumptions, but the attempt is either inaccurate or incomplete.
1	Completes conversion of information but resulting mathematical portrayal is inappropriate or inaccurate.	Calculations are attempted but are unsuccessful and not comprehensive.	Attempts to explain information presented in mathematical forms, but draws incorrect conclusions about what the information means.	Analysis is attempted but is inaccurate and incomplete.