MTH 20 Rubric for
Core Learning Outcome:
Communicate

	Exemplary	Proficient	Emergent	Inadequate
Interpretation *Ability to explain and apply information presented in mathematical forms (equations, expressions, tables, graphs, diagrams, words)*	Demonstrates an understanding of mathematical forms of communication by following specific directions regarding procedure or form. Demonstrates correct interpretation of tasks by rephrasing the problem accurately or by setting out on a reasonable path toward a correct solution.	Demonstrates an understanding of mathematical forms of communication by attempting to follow specific directions regarding procedure or form. Provides evidence of understanding of main purpose of task, but leaves out minor aspects when rephrasing the problem or showing work.	Demonstrates an incomplete understanding of mathematical forms of communication by following only portions of the directions regarding procedure or form.	Interprets tasks incorrectly. Demonstrates misunderstanding of purpose by incorrectly rephrasing the problem or by setting out on a path toward a different goal than the one that was set.
Communication *Ability to explain quantitative reasoning in support of conclusions*	Shows (using symbols or diagrams) and/or explains (using words) how quantitative information is used to accomplish the purpose of the task. Explanation is complete and meaning is clearly conveyed.	Shows (using symbols or diagrams) and/or explains (using words) how quantitative information is used to accomplish the purpose of the task. Explanation is incomplete or incorrect, but meaning is clearly conveyed.	Attempts to show how quantitative information is used to accomplish the purpose of the task. Meaning is not clearly conveyed due to poor organization, incomplete explanation, misuse of vocabulary or symbols, or lack of content mastery.	Provides answers (either correct or incorrect) without attempting to show or explain quantitative reasoning. No recognition of incompleteness of response or inappropriate use of symbols and/or conventions.
Context *Ability to choose methods and symbology that are efficient and appropriate for the context of the task*	Demonstrates an understanding of context and purpose of tasks by producing work that is responsive to and focused on the assigned task with exemplary brevity and appropriate form.	Demonstrates an understanding of context and purpose by producing work that is responsive to and focused on the assigned task with appropriate brevity and relevant (though possibly not correct) form.	Demonstrates incomplete understanding of purpose. Produces work that is somewhat related to the assigned task, but has insufficient or misplaced focus.	Demonstrates minimal attention to context or purpose of tasks. Form of work is not responsive to intended purpose.
Syntax & Mechanics *Ability to explain reasoning using correct grammar and correct mathematical symbols*	Skillfully communicates reasoning to readers with clarity and fluency. Correctly uses mathematical symbols and vocabulary to make communications efficient and correct.	Communicates reasoning to readers with clarity, but uses mathematical symbols and/or vocabulary incorrectly.	Communicates portions of reasoning to readers with clarity, but reasoning is incomplete due to omissions of key points or incorrect usage of mathematical symbols and/or vocabulary	Communicates reasoning poorly. Errors in usage of mathematical vocabulary and/or symbols impede meaning significantly.
Disciplinary Conventions *Ability to demonstrate conventional formats and methods, and utilize conventional language and symbology to convey reasoning*	Demonstrates attention to and successful execution of mathematical conventions such as line-by-line format for solving equations and simplifying expressions, "five-step" approach for solving word problems, presenting fractions in simplified form, supporting all conclusions with mathematical reasoning, taking cues for form from the original statement of the problem.	Demonstrates conventional formats and methods for presenting work, but consistently excludes one or more key steps from work.	Attempts to use conventional approaches for organizing and presenting work, but some misunderstandings are apparent.	Attempts to use a consistent (though unconventional) system for basic organization and presentation of work.
Self-Evaluation *Ability to qualitatively self-evaluate contextualized skills and methods*	Demonstrates ability to assess methods and reasonableness of response. Describes alternative approaches and evaluates their relative efficiency.	Able to explain reasonableness of answer. Notes that alternative approaches exist, but discussion does not include comparison.	Incorrect answers are minimally supported by reasoning and explanation. Self-recognition of inadequateness of response.	Response is incorrect and unsupported, with no recognition of error or inappropriateness of response.

*GENERAL COURSE OBJECTIVES (G.C.O.) for MATH 20:

Upon completion of this course the student will:
1. Apply reasoning and problem solving skills to basic mathematics problems.
2. Use estimation in basic math problems.
3. Check the reasonableness of answers.
4. Perform fraction computations and applications with accuracy.
5. Perform decimal computations and applications with accuracy.
6. Write and simplify ratios and rates.
7. Recognize when and where ratios or proportions apply.
8. Set up and solve proportions.
9. Convert between fractions, decimals, and percents.
10. Solve the three basic types of percent problems.
11. Set up and solve percent application problems.
12. Solve applications using area and perimeter of simple geometric shapes.
13. Solve basic equations of the type a + x = b and ax = b, involving whole numbers, fractions and decimals.
14. Use a scientific calculator to explore and solve basic math problems.
15. Apply study skills for learning mathematics and for coping with math anxiety.
16. Use the symbols and vocabulary of basic mathematics correctly.
17. Use American and metric measurement.

Discipline Dimension	CLO dimension assessed	General Course Objectives addressed
Interpretation	**Attend** to messages, check for shared meaning, identify sources of misunderstanding, and signal comprehension or non-comprehension.	All objectives are related. Students demonstrate this dimension by following directions.
Communication	**Create and express** messages with clear language and nonverbal forms appropriate to the audience and cultural context.	All objectives are related. Students demonstrate this dimension by communicating reasoning.
Context	**Select** an effective and appropriate medium (such as words, mathematical symbols, diagrams, or graphs) for conveying the message.	G.C.O. # 7, 16
Syntax & Mechanics	**Support** assertions with contextually appropriate and accurate examples, graphics, and quantitative information.	G.C.O. # 16
Disciplinary Conventions	**Organize** the message to adapt to cultural norms, audience, purpose, and medium.	G.C.O. # 1, 2, 3, 4, 5, 13, 14, 16, 17
Self-Evaluation	**Demonstrate** openness to alternative views and methods.	G.C.O. # 3

Note: Mathematics instruction incorporates two components: content and practices. This is supported by the Common Core State Standards for Mathematics, which includes both "Standards for Mathematical Practice" and "Standards for Mathematical Content". The General Course Objectives describe the content, while the college's Core Learning Outcomes relate more to practices. Therefore, it is difficult to correlate specific course objectives with specific core learning outcomes.

MTH 20 Content Examples

	Exemplary	Proficient	Emergent	Inadequate
Interpretation *Use fraction notation to write the ratio of 2.4 to 8. Then simplify the ratio.*	$\dfrac{2.4}{8} = \dfrac{24}{80} = \dfrac{8\cdot 3}{8\cdot 10} = \dfrac{3}{10}$	$\dfrac{8}{2.4} = \dfrac{1}{0.3}$	2.4:8 $8\overline{)24}^{\,3}$	$2.4\overline{)8.00}^{\,0.33}$
Communication *Explain how to convert a fraction to a percent number without first converting it to a decimal.*	You can convert any fraction or decimal to a percent number by multiplying it by 100%. You can do this because 100% equals 1. For example, I can change ½ to a percent number by doing $\dfrac{1}{2}\cdot\dfrac{100\%}{1} = \dfrac{100}{2}\% = 50\%$	I don't know how to do fractions, but you can convert it to a decimal by using division. Like for the fraction ½, you could do $2\overline{)1.0}^{\,0.5}$. Then you could move the decimal point two places to get 50. Then you know the fraction ½ is the same as 50%.	You multiply by 100. $0.5 \times 100 = 50\%$	You do like $\dfrac{1}{2} = 50\%$
Context *Translate the percent question to a proportion. What is 25% of 16?*	$\dfrac{25}{100} = \dfrac{x}{16}$	$\dfrac{25}{100} \times \dfrac{x}{16}$	$\dfrac{25}{100} \quad \dfrac{x}{16} \quad \dfrac{100x}{400}$	$x = 25\%\cdot 16$ $x = .25\cdot 16$ $x = 2$
Syntax & Mechanics *Use the Order of Operations to simplify the expression:* $2 + 3(5-1) \div 6$	$2 + 3(5-1) \div 6$ $2 + 3(4) \div 6$ $2 + 12 \div 6$ $2 + 2$ 4	$5 - 1 = 4 \times 3 = 12 \div 6 = 2 + 2 = 4$	$5 - 1 = 4$ $2 + 3 = 5$ $4 \times 5 = 20 \div 6 = 0.3$	Order of Operations is PEMDAS so you 5-1 first and so times 4 by 3=12/6=2. The answer is 4.
Disciplinary Conventions *Solve using the vertical format:* $5x = 10$	$5x = 10$ $\dfrac{5x}{5} = \dfrac{10}{5}$ $x = 2$	$5x = 10$ $\underline{-5 \quad -5}$ $x = 5$	$5x = 10$ $5\overline{)10}^{\,2}$ $x = 2$	$5\cdot 2 = 10$

Ideas for Tasks/Projects to assess Communication

Have students read the textbook (or other instructional material) and attempt to answer related questions without verbal instruction. (Interpretation)

Ask questions with specific instructions using vocabulary from the course and see if students follow the instructions correctly. (Interpretation, Context)

Provide mixed practice where topics are varied and students must read the directions in order to know what to do rather than only providing practice that can be completed by following a mechanical procedure. (Interpretation, Context)

Assign word problems. (Interpretation, Communication, Context, Syntax & Mechanics, Disciplinary Conventions)

Assign a project applying one key concept of the curriculum to students' real world experiences. (Interpretation, Communication, Context, Syntax & Mechanics, Disciplinary Conventions)

Have students program a spreadsheet.

Have students use "Graph and Data" functions in MS Word (or similar word-processing program) as communication tools for a project.

Have students discuss or summarize in writing the main points of a lesson. (Communication, Context)

Provide "What's Wrong?" activities, where students analyze given solutions to a problem to identify and explain errors in reasoning.

Have students prepare written questions for class. (Communication)

Assign questions that require analytical thinking and have students share their explanations with a group (e.g. instead of asking students to convert a given percent number to a decimal, ask them why we move the decimal point two places to the left when converting from a percent to a decimal.)(Interpretation, Communication)

Include questions on homework and tests that require written explanation rather than providing only computational questions that might be answered using a "shortcut" that does not require conceptual understanding. (Interpretation, Communication)

Encourage/require accurate use of vocabulary and notation in student work. (Syntax & Mechanics)

Encourage/require students to format their work in conventional ways by giving feedback on assignments and tests. (Disciplinary Conventions)