Fitchburg State University General Education Program: Quantitative Reasoning Rubric

Goal: Fitchburg State University students will analyze and interpret mathematical information as a means to evaluate arguments and make informed choices.

	Internalizing	**Refining**	**Developing**	**Emerging**
Define and Represent the Problem: Determine the knowns and unknowns of a situation and use that to decide if quantitative methods are appropriate to apply. Convert relevant given information into useful quantitative forms: tables, graphs, numbers, variables, etc.	Consistently constructs a clear statement of the problem to be solved, identifies the knowns and unknowns, and converts those elements into mathematical objects where quantitative methods can be applied.	Mostly constructs a clear statement of the problem to be solved, identifies the knowns and unknowns, and converts those elements into mathematical objects where quantitative methods can be applied.	Sometimes. constructs a clear statement of the problem to be solved, identifies the knowns and unknowns, and converts those elements into mathematical objects where quantitative methods can be applied. Students can convert problem elements into mathematical objects when prompted for a particular object, but would struggle to choose an appropriate object.	Rarely constructs a clear statement of the problem to be solved, identifies the knowns and unknowns, and converts those elements into mathematical objects where quantitative methods can be applied. At this level, a student should be able to connect verbal descriptions to given quantitative forms, but would struggle to create their own graphs/tables/etc.
Determine an Algorithm: Choose from or combine known processes and tools appropriate for solving the problem.	Consistently chooses an appropriate tool, formula, or process and insightfully discusses the relevant details in an analysis or explanation of that choice.	Mostly chooses an appropriate tool, formula, or process and insightfully discusses the relevant details in an analysis or explanation of that choice. A student should be solid at choosing/justifying a single familiar process or tool, but may struggle to combine multiple algorithms appropriately.	Sometimes chooses an appropriate tool, formula, or process and insightfully discusses the relevant details in an analysis or explanation of that choice. A student at this level may often choose the appropriate tool, but with faulty or simplified reasoning. May not recognize the correct tool in less familiar contexts.	Rarely chooses an appropriate tool, formula, or process and insightfully discusses the relevant details in an analysis or explanation of that choice. A student can explain when prompted why a certain tool is appropriate (maybe not in much detail), but may struggle to complete the task on their own.

Generate a Solution: Use appropriate technology, processes, and tools to make accurate computations in support of the solution.	Consistently applies the relevant formulas and processes correctly. All calculations are completed with a suitable degree of accuracy, and the computational steps are outlined clearly with documentation of appropriate technology use. This solution may still have computational errors, but they occur in the skills not being assessed, e.g. an arithmetic error when evaluating a definite integral.	Mostly applies the relevant formulas and processes correctly. Most calculations are completed with a suitable degree of accuracy, and the computational steps are outlined clearly with documentation of appropriate technology use. This solution has errors, but they occur within an overall correct and clearly presented process.	Sometimes applies the relevant formulas and processes correctly. Some calculations are completed with a suitable degree of accuracy, and the computational steps are outlined clearly with documentation of appropriate technology use. Errors in these solutions occur in the steps and skills being learned or practiced, but the student also correctly demonstrates the same or similar steps elsewhere.	Rarely applies the relevant formulas and processes correctly. Most calculations are incomplete or inaccurate. The steps are not organized and show a lack of understanding in the process required.
Interpretation: Translate quantitative information from tables, graphs, formulas, etc. into verbal descriptions of processes and solutions.	Consistently, correctly, and confidently translates quantitative information from tables, graphs, formulas, etc. into verbal descriptions of processes and solutions.	Mostly, correctly, and confidently translates quantitative information from tables, graphs, formulas, etc. into verbal descriptions of processes and solutions.	Sometimes, correctly translates quantitative information from tables, graphs, formulas, etc. into verbal descriptions of processes and solutions. A student may choose a correct interpretation of quantitative information from a provided list of options, but struggles to generate their own.	Rarely correctly translates quantitative information from tables, graphs, formulas, etc. into verbal descriptions of processes and solutions. A student may make some correct interpretations, but also makes some incorrect or incomplete interpretations.
Evaluation: Determine if the outputs and results of the procedure are reasonable and accurate and revise if necessary by considering errors or alternate approaches.	Consistently applies content knowledge to assess the reasonableness and accuracy of a solution. Systematically investigates the work to determine the sources of any inaccuracies, and revises or adjusts the steps accordingly.	Mostly applies content knowledge to assess the reasonableness and accuracy of a solution. Systematically investigates the work to determine the sources of any inaccuracies, and revises or adjusts the steps accordingly. At this level students should be able to assess the reasonableness of their solutions, but may struggle to find errors.	Sometimes applies content knowledge to assess the reasonableness and accuracy of a solution. Systematically investigates the work to determine the sources of any inaccuracies, and revises or adjusts the steps accordingly.	Attempts, but struggles, to apply content knowledge to assess the reasonableness and accuracy of a solution. A student may notice that a final answer is a positive number, but fail to see that the quantity is far too large or small to be reasonable.

Analysis and Communication: Make appropriate conclusions, support those with quantitative evidence and explain the results to the intended audience.	Consistently makes accurate and comprehensive conclusions from the computations, effectively communicates those conclusions to the intended audience, and supports those conclusions with quantitative evidence. At this level, we expect students to have developed explanations that reflect their own understanding, rather than simply fitting an already shared explanation to a particular example.	Mostly makes accurate and comprehensive conclusions from the computations, effectively communicates those conclusions to the intended audience, and supports those conclusions with quantitative evidence. Conclusions are accurate and logical, but follow a template format that calls into question their complete understanding of the conclusion	Sometimes makes accurate and comprehensive conclusions from the computations, effectively communicates those conclusions to the intended audience, and supports those conclusions with quantitative evidence. Conclusions could be accurate, but supported with faulty logic or irrelevant data or quantities. The logic toward the conclusion is accurate, but the incorrect conclusion was stated.	Rarely makes accurate and comprehensive conclusions from the computations, effectively communicates those conclusions to the intended audience, and supports those conclusions with quantitative evidence. Conclusion is incorrect and there are errors or inconsistencies in the logic toward the conclusion, but there is some evidence of understanding the process toward the conclusion.
Personal Reflection: Discussion of personal confidence and attitude towards Quantitative Reasoning, willingness and potential to apply QR skills, and reflections on a student's own learning processes.	Students show broadly positive attitudes to their mathematical abilities. They can discuss examples from their work of persistence through struggles and learning from their past mistakes. Students can clearly state their own understanding of the relevance of quantitative reasoning to their studies and their life as informed citizens.	Students show broadly positive (or improving) attitudes to their mathematical abilities. They can discuss examples from their work of persistence through struggles and learning from their past mistakes. Students can state the relevance of quantitative reasoning to their studies and their life as informed citizens.	A student has begun to demonstrate their ability to learn from their mistakes, gain confidence in applying quantitative skills, and seeing the relevance of quantitative reasoning skills to their lives.	Students continue to see themselves as "not a math person" or do not frame quantitative skills as relevant to them or only demonstrate clearly predefined connections with mathematics and the world they live in.

Quantitative Reasoning Rubric

Quantitative Reasoning Goal

Fitchburg State University students will analyze and interpret mathematical information as a means to evaluate arguments and make informed choices.

Understanding the Rubric

The rubric focuses on seven criteria:

1. Define and Represent the Problem: Determine the knowns and unknowns of a situation and use that to decide if quantitative methods are appropriate to apply. Convert relevant given information into useful quantitative forms: tables, graphs, numbers, variables, etc.
2. Determine an Algorithm: Choose from or combine known processes and tools appropriate for solving the problem.
3. Generate a Solution: Use appropriate technology, processes, and tools to make accurate computations in support of the solution.
4. Interpretation: Translate quantitative information from tables, graphs, formulas, etc. into verbal descriptions of processes and solutions.
5. Evaluation: Determine if the outputs and results of the procedure are reasonable and accurate and revise if necessary by considering errors or alternate approaches.
6. Analysis and Communication: Make appropriate conclusions, support those with quantitative evidence and explain the results to the intended audience.
7. Personal Reflection: Discussion of personal confidence and attitude towards Quantitative Reasoning, willingness and potential to apply QR skills, and reflections on a student's own learning processes.

The rubric has four levels of performance with a consistent distinguishing term in each criterion.

Performance Level	**Distinguishing Term**	**Explanation: The student artifact is . . .**
Internalizing	Consistently	nearly perfect in meeting the criteria (~100%).
Refining	Mostly/Frequently	above average in meeting the criteria (~75%).
Developing	Partially/Sometimes	average in meeting the criteria (~50%).
Emerging	Minimally/Rarely	in the early stages of meeting the criteria (25% or less)