Quantitative Reasoning

Student Learning Outcome: Students will demonstrate an ability to interpret mathematical models in the form of formulas, graphs, and/or tables and draw inferences from them.

The Value of Quantitative Reasoning

The contemporary world is extremely data-driven. An ability to gather and analyze information is requisite for an individual to be literate and able to function in the contemporary world. Quantitative Reasoning courses give students the basic tools of mathematical and/or statistical analysis as well as the concepts and tools to be able to gather, sort, and interpret information. A strong foundation in quantitative analysis allows students to use information to solve problems in fields ranging from engineering to political science.

Supporting Skills

1. Students will interpret and translate between multiple different representations of information, such as visual, numerical, symbolic, and/or verbal representations.
2. Students will use equations and/or principles to solve for an unknown quantity.
3. Students will evaluate whether an argument or conclusion is valid and/or reasonable.
4. Students will articulate an argument for an issue that uses quantitative data in a meaningful way.

Course Content Criteria

1. Courses in this category have, as a primary focus, the manipulation or analysis of numerical data.
2. Courses in this category require students to read, interpret, and use mathematical formulas on a regular basis.
3. Courses in this category require students to identify, select, and recognize numerical data appropriate to solving specific problems.
4. Courses in this category require students to draw inferences and/or conclusions from visual, numerical, symbolic, and verbal representations of information.
5. Courses in this category utilize data visualization in order to display mathematical functions or relationships in data.
6. Courses in this category include an assessment assignment that requires students to demonstrate each of the skills in the Quantitative Reasoning Assessment Rubric (below). This assessment assignment should be one of the following: an objective exam, an essay question on an exam, an essay, or a research paper.

Glossary

1. **Argument:** A reason or set of reasons supporting an opinion, assertion, interpretation of a data analysis, or mathematical theorem.
2. **Conclusion:** A judgment or decision reached through reasoned analysis of quantitative information.
3. **Equation:** Mathematical statement that two expressions are equal; these expressions may contain variables, numbers, mathematical symbols, and/or grouping symbols.
4. **Issue:** An important topic or problem for debate or discussion, for example how to understand the rate of spread of a disease and how many people are infected, how to determine which mortgage option is the best, or how to determine how climate patterns affect the incidence of natural disasters.
5. **Manipulation or analysis of numerical data:** Performing a technique in order to aggregate isolated information into a value or representation that can allow for appropriate interpretation in the context of the data.
6. **Principle:** A fundamental mathematical operation that is widely accepted as an analytical tool in mathematics.
7. **Visual representations of information:** In this context, graphs, tables, or schematics that represent quantitative information.

Quantitative Reasoning Assessment Rubric

Supporting Skills	Exemplary 5	Accomplished 4	Developing 3	Beginning 2	Absent 1
Interpret multiple different representations of information, such as visual, numerical, symbolic, and/or verbal representations.	Is able, with a high degree of accuracy, to draw conclusions from complex representations of information.	Is able, with a moderate degree of accuracy, to draw conclusions from complex representations of information.	Is able, with a moderate degree of accuracy, to draw conclusions from basic representations of information.	Demonstrates limited understanding of the frameworks of interpretation, but draws mostly inaccurate conclusions from representations of information.	Is unable to draw any conclusions from representations of information, even those that are basic.
Use equations and/or principles to solve for an unknown quantity.	Is fluent in solving for quantities, using equations or principles, even for complex relationships	Is able to solve all but the most complex problems using equations or principles.	Is able to make progress on solving problems using equations or principles, but the solution is incomplete.	Is able to make partial progress on solving problems using equations or principles, and often gets incorrect answers or cannot complete the solution.	Is unable to solve even simple problems using equations or principles.
Evaluate whether an argument or conclusion is valid and/or reasonable.	Able to offer a sophisticated evaluation of the validity of complex arguments and conclusion.	Able to offer a basic evaluation of the validity of complex arguments and conclusions.	Able to offer a partial evaluation of the validity of arguments and conclusions, such that the student can determine, at a minimum, whether the reasoning is valid.	Can recognize when an argument is not correct, but cannot articulate the reason why the argument is invalid.	Student is unable to recognize incorrect answers or conclusions for even the simplest problems.
Articulate an argument for an issue that uses quantitative data in a meaningful way.	Articulates a complex argument by devising innovative methods to use quantitative data.	Articulates an argument by applying standard methods to use quantitative data.	Articulates a simple argument using quantitative information.	Articulates a simple argument but sometimes uses the incorrect information to do so.	Is unable to use information to articulate a reasonable argument.