

University of Wisconsin - Madison

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The formal implementation of the General Education requirements, including a Quantitative Reasoning (QR) requirement, began with the entering class in 1996-97. The QR requirement, as approved by the UW Faculty Senate, consists of two parts:

- **QR-A:** 3 credits in mathematics, computer science, statistics, or formal logic.
- **QR-B:** 3 additional credits in quantitative reasoning.

Exemption from QR-A is possible with sufficiently high mathematics placement scores.

Exemption from QR-B is not possible.

An Implementation Committee was formed, of which I was chair. I continue to be the Liason (for the General Educational Committee) for Quantitative Reasoning Courses.

Working Definition of QR: Quantitative Reasoning is the process of forming conclusions, judgements or inferences from quantitative information. There are many aspects to quantitative reasoning. These include the recognition and construction of valid mathematical models that represent quantitative information; the analysis and manipulation of these models; the drawing of conclusions, predictions or inferences on the basis of this analysis; and the assessment of the reasonableness of these conclusions.

Criteria for a QR-A course: To be certified as a QR-A course, a course must provide students with skills in mathematics, computer science, statistics or formal logic that are needed for dealing with quantitative information. The skills must be broad-based in order that they have a positive impact on the readiness of students to take a QR-B course in a variety of disciplines.

More specifically, a **QR-A course in MATHEMATICS** should be primarily concerned with:

- Properties and techniques of number systems: development of number sense, exact calculation, approximate calculation (estimation), identification of fallacious computations, use of calculation algorithms with technological assistance.
- Measurement of quantitative variables: counting, uncertainty (chance), rates/change (percentages), growth, shape, areas, volumes, dimension, Practice with units.
- Modelling: representation and interpretation of quantitative relationships, arithmetically, symbolically, geometrically, graphically, and/or statistically.
- Deductive and inductive arguments, recognizing fallacious arguments.
- Development of problem solving skills through solving non-routine problems dealing with quantitative information.

Criteria for QR-B courses: A QR-B course must make significant use of quantitative tools in the context of other course material, for example:

- the recognition and construction of mathematical models and/or hypotheses that represent quantitative information,
- the evaluation of these models and hypotheses,
- the analysis and manipulation of mathematical models,
- the drawing of conclusions, predictions, or inferences, and
- the assessment of the reasonableness of conclusions.

A QR-B course may, but is not required to, focus on quantitative reasoning in one specific discipline.

Courses that do not satisfy the criteria for QR-B courses include those that deal with quantitative information **ONLY** in one or more of the following ways:

- Students are given a mathematical model (equations, formulas, ...) and are merely required to produce a numerical or qualitative answer through routine calculations or symbolic manipulation.
- Students are required to use a computer package to perform calculations or carry out a study without subjecting their results to critical analysis, comparing them to other numerical data, arriving at conclusions, predictions or inferences, and assessing their reasonableness.
- Students are required to deal with quantitative information in primarily descriptive or conceptual ways. For example, courses in “research methods” that lack a substantial reasoning component based on tools covered in a QR-A course would not be certified.

Materials requested in submitting courses for QR-B certification are:

- Detailed course outline including topics and readings.
- Indication of which of the QR-A skills will be used (see the various criteria for QR-A courses in mathematics, statistics, computer science, formal logic that are attached).
- Indication of which of the QR-B criteria the course will emphasize (see the criteria for QR-B courses above).
- Examples of typical exercises.
- Sample examination questions.

Recommendations approved by the Implementation Committee include:

- A QR-A must be completed within the first 60 credits earned. A student should satisfy the QR-A requirement before satisfying the QR-B requirement.

The reason for this recommendation is that if the quantitative reasoning requirement is to have some effect on a student's ability to use quantitative reasoning in other courses (and not merely be an exit requirement), then the requirement should be satisfied early on.

- In order for a course to be approved as a QR-B course, it must have as a prerequisite the completion of a QR-A course. This prerequisite may be either a specific QR-A course or any QR-A course.

The reason for this recommendation that QR-B courses are to make substantial use of some of the skills to be developed in QR-A courses.

- Exemption from the QR-A requirement shall mean a score on placement tests that is high enough for entrance into Math 114 (combined College Alg. and Trig).

Students who are exempted from QR-A supposedly have demonstrated, through the placement tests, a level of mathematical knowledge and skills which is higher than Math 101 (Intermediate Alg.) but not necessarily as high as expected upon completion of Math 112 (College Alg.). Using this exemption criterion avoided creating (perhaps artificially) a new cutoff level on the placement exams.

QR-A courses

- College Algebra (which includes quantitative reasoning)
- Quantitative Reasoning and Problem Solving (a course being developed as a result of the QR-requirement.)
- Arithmetical Problem Solving (for prospective elementary school teachers)
- Reason in Communication (Philosophy Department)

QR-B courses in various departments:

- Accounting (Business)
- Astronomy
- Botany
- Chemistry
- Communication Arts
- Computer Science
- Color Theory and Technology (Environment, Textiles, and Design: School of Human Ecology)
- Economics
- Educational Psychology
- Environmental Studies, Ecology, ...
- Food Science
- Forestry
- Geography
- Geology
- Horticulture
- Mathematics
- Philosophy (Elementary Logic)
- Physics
- Political Science

- Psychology
- Sociology
- Statistics
- Zoology

MATH 141 - QUANTITATIVE REASONING (3 credits)

- Estimation, percentages, rates and other linear relations.
- Quadratic equations and quadratic relations.
- Exponential relations (exponential growth and decay).
- Counting and probability (measuring chance).
- Other topics