**Quantitative Reasoning A (Math) Requirement Assessment Plan**

Math 1030, 1090 and 1050 are the main courses that satisfy the Quantitative Reasoning A Math (QA) requirement for most students at the University of Utah. Below are the outcomes for each of the courses and then a synthesized list of outcomes for the QA requirement.

**Assessment**

In the first year, we will measure the accomplishment of the first five outcomes in each list of course outcomes by identifying final projects or questions on the departmental (common) final exams that will inform the outcomes. See detail below. In the second year, we will examine the remainder of the outcomes in each list using similar methods.

After the second year, we will have examined all of the course outcomes and we will be able to determine if the existing data we have can be used to assess the synthesized outcomes for the overall requirement…

**Math1030**

Upon successful completion of this course, a student should be able to:

1.   Use Venn diagrams to examine relationships between sets and the validity of simple deductive arguments.

2.   Use an appropriate sentence to describe both the absolute and percent change in a given quantity and interpret such statements about the change.

3.   Use simple and compound units, making conversions when necessary, and develop accurate comparisons between units.

4.   Evaluate the impact of compound interest on simple financial decisions.

5.   Use the savings plan and loan formulas to calculate the payment amount into the savings plan when a certain financial goal needs to be achieved, to calculate the mortgage payment or interest paid over the life of the loan and discuss whether those results are realistic (or not), compare several loans with different interest rates in order to financial decisions.

6.   Compare and illustrate the features of linear and exponential growth using practical examples.

7.   Determine simple areas, volumes, and explain the differential effect of scaling on perimeter, area, volume as well as some of the practical implications of scaling.

**Math 1090**

Upon successful completion of this course, a student should be able to:

1.   Graph and analyze quadratic, exponential and logarithmic functions; solve quadratic, exponential and logarithmic equations.

2.   Understand what a mathematical function is and know how to use linear, quadratic, logarithmic and exponential functions to model real world examples.

3.   Know how to solve a system of linear or quadratic equations that arise in business applications.

4.   Find solutions to linear programming problems, to maximize a function over a geometric region.

5.   Perform simple matrix algebra computations.

6.   Use matrices to solve systems of linear equations.

7.   Understand what an inverse function is and be able to find the inverse function, when it exists.

8.   Distinguish between simple and compound interest situations.

9.   Calculate future and present value of annuities, and know when to use which formula for the life application.

10.Compute an amortization schedule and loan payments, such as automobile or mortgage payments.

**Math 1050**

Upon successful completion of this course, a student should be able to:

1.   Sketch the graph of basic polynomials (second and third order), rational, radical, exponential, logarithmic, and piecewise functions with or without transformations. Be able to identify important points such as x and y intercepts, maximum or minimum values; domain and range; and any symmetry.

2.   For rational functions, identify x and y intercepts, vertical, horizontal and oblique asymptotes (end behavior), and domain. Use information to sketch graphs of functions.

3.   For polynomial functions, identify all zeros (real and complex), factors, x and y intercepts, end behavior and where the function is positive or negative. Use information to sketch graphs.

4.   Understand the connections between graphic, algebraic, and verbal descriptions of functions.

5.   Given the graph of a function, be able to identify the domain, range, any asymptotes and/or symmetry, x and y intercepts, as well as find a rule for the function if it is obtained from a standard function through transformations.

6.   Define i as the square root of -1 and know the complex arithmetic necessary for solving quadratic equations with complex roots.

7.   Solve absolute value, linear, polynomial, rational, radical, exponential and logarithmic equations and inequalities.

8.   Find the inverse of a function algebraically and graphically.

9.   Perform composition of functions and operations on functions.

10.Understand sequences and be able to differentiate between geometric, arithmetic, and others such as Fibonacci-type sequences giving direct formulas where available.

11.Understand series notation and know how to compute sums of finite or infinite arithmetic or geometric series.

12.Solve systems of equations (3x3 linear) and non-linear equations in two variables.

13.Make sense of algebraic expressions and explain relationship among algebraic quantities including quadratic, exponential, logarithmic, rational, radical, and polynomial expressions, equations and functions.

14.Represent and interpret "real world" situations using quadratic, exponential, logarithmic, rational, radical and polynomial expressions, equations, and functions.

**QA Learning Outcomes**

1. Explain algebraic expressions and the relationship among algebraic quantities including quadratic, exponential, and logarithmic expressions, equations and functions.
2. Identify the role of a mathematical function and use linear, quadratic, logarithmic and exponential functions to model real world examples.
3. Demonstrate how to model and interpret "real world" situations using algebra, geometry, and conversions, including how this applies to financial decisions typically made by adult citizens.
4. Compare and illustrate the features of linear and exponential growth using practical examples and/or given sequences.
5. Develop critical thinking skills necessary to tackle any quantitative problem with at least some starting idea and the persistence to see it through to the end.

Additionally, here is what has been written on USHE web pages regarding what QL is supposed to be.

<https://higheredutah.org/r470-general-education-common-course-numbering-lower-division-pre-major-requirements-transfer-of-credits-and-credit-by-examination/>

**3.2.2. Quantitative Literacy (3-4 credits)**: Students may satisfy this requirement by completing at least one institutionally-approved mathematics course that clearly demonstrates quantitative reasoning skills beyond those found within required high school Mathematics courses and that is an appropriate introductory university level. Approved courses will significantly focus on the following: (1) Interpretation-explain information presented in mathematical forms (e.g., equations, graphs, diagrams, and tables); (2) Representation-convert relevant information into various mathematical forms (e.g., equations, graphs, diagrams, and tables); (3) Calculation-demonstrate the ability to successfully complete basic calculations to solve problems; (4) Application/Analysis-make judgments and draw appropriate conclusions based on quantitative analysis of data, recognizing the limits of this analysis; (5) Assumption-make and evaluate important assumptions in estimation, modeling, and data analysis; (6) Communication-express quantitative evidence in support of the argument or purpose of the work (in terms of what evidence is used and how it is formatted, presented, and contextualized); and (7) Creation-demonstrate the ability to problem solve using quantitative literacy across multiple disciplines. Traditionally, this requirement has been fulfilled by completion of MATH 1030 Quantitative Reasoning, MATH or STAT 1040 Statistics, MATH 1050 College Algebra, or other institutionally-approved courses.