

April 9, 2015

HECC Staff Recommendation to the Higher Education Coordinating Commission regarding the Associate of Arts/Oregon Transfer Foundational Requirement for Mathematics

Following consensus support from the Community College Council of Instructional Administrators (CIA) and University Provost Council, JBAC proposes a revision in the Foundational Requirements of the AAOT. Staff recommends that the following revision be approved by the Commission.

Current: One course in college-level mathematics, for which Intermediate Algebra is a prerequisite.

Proposed: One course in college-level mathematics **designated by the college as meeting the statewide criteria for mathematics.**

For the following agreed-upon reasons:

- Through its Math Pathways work, JBAC has found that Intermediate Algebra (Math 95) best serves a particular niche of students—those preparing for College Algebra and a calculus-focused college mathematics track.
- The AAOT's restriction on Intermediate Algebra for college-level mathematics courses was established prior to the development of the statewide outcomes and criteria for transferable general education college mathematics courses.
- Extensive work has been done across many community colleges to develop an alternative pathway into college mathematics that is based on quantitative literacy and statistics. Several colleges are currently offering a newly-developed Quantitative Literacy (Math 98) course.
- Math in Society (Math 105) has been found to meet university math requirements for all public universities in Oregon. Many students earning Bachelor of Arts degrees at Oregon universities take only Math 105 to meet their university math requirements.
- Math faculty from all Oregon community colleges and 4 of the 7 universities participated in an alignment meeting in Fall 2014 to develop agreed-upon statewide outcomes, topics, and prerequisite skills for Math 105. An alignment meeting was held in Winter 2015 to begin development of similar consistency for Math 98, which may serve as a prerequisite for MTH 105.
- Upon review of these courses and in light of disciplinary discussions during the JBAC Math Pathways convening of faculty in mathematics and biology, chemistry, economics, physics, psychology, and sociology, we find that Math 105 counts toward the AAOT, as it meets the statewide outcomes and criteria.
- JBAC, Provost Council and CIA agree that the prerequisite language in the AAOT for mathematics be removed and replaced with specific reference to the outcomes and criteria for transferable General Education Mathematics courses in Oregon.

Additional relevant background information is included to support this proposal.

Proposed Change in AAOT Foundational Requirement

Associate of Arts-Oregon Transfer: [http://handbook.ccwwebforms.net/handbook/programs-degrees-and-certificates/definitions/associate-degrees/associate-of-arts-oregon-transfer-\(aa-ot\)](http://handbook.ccwwebforms.net/handbook/programs-degrees-and-certificates/definitions/associate-degrees/associate-of-arts-oregon-transfer-(aa-ot))

Foundational requirements

- *Writing:* Students taking writing classes of three credits each must take WR 121, 122, and either WR 123 or 227. Students taking writing classes of 4 credits each must take WR 121 and either WR 122 or 227. A student must have eight credits of Writing.
 - Information Literacy will be included in the Writing Requirement.
- *Oral Communication:* One course in the fundamentals of speech or communication designated by the college as meeting the statewide criteria for speech communication.
- *Mathematics:* One course in college-level mathematics, ~~for which Intermediate Algebra is a prerequisite~~ designated by the college as meeting the statewide criteria for mathematics.
- *Health/Wellness/Fitness:* One or more courses totaling at least three credits.

Background:

Outcomes and Criteria for Transferable General Education Courses in Oregon excerpt:
<http://handbook.ccwwebforms.net/handbook/appendices/appendix-k>

Mathematics

OUTCOMES

As a result of taking General Education Mathematics courses, a student should be able to:

- Use appropriate mathematics to solve problems; and
- Recognize which mathematical concepts are applicable to a scenario, apply appropriate mathematics and technology in its analysis, and then accurately interpret, validate, and communicate the results.

CRITERIA

A collegiate level Mathematics course should require students to:

- 1) Use the tools of arithmetic and algebra to work with more complex mathematical concepts.
- 2) Design and follow a multi-step mathematical process through to a logical conclusion and judge the reasonableness of the results.

- 3) Create mathematical models, analyze these models, and, when appropriate, find and interpret solutions.
- 4) Compare a variety of mathematical tools, including technology, to determine an effective method of analysis.
- 5) Analyze and communicate both problems and solutions in ways that are useful to themselves and to others.
- 6) Use mathematical terminology, notation and symbolic processes appropriately and correctly.
- 7) Make mathematical connections to, and solve problems from, other disciplines.

The Outcomes and Criteria statements in Mathematics were developed from 2007-2009 by:

Mariah Beck	Math	Umpqua Community College
Janet Brougher	Math	Rogue Community College
Ben Cornelius	Math	Oregon Institute of Technology
Tom Dick	Math	Oregon State University
Phyllis Leonard	Math	Chemeketa Community College
Neal Ninteman	Math	George Fox University
Jeanette Palmiter	Math	Portland State University
Julie Rowland	Math	Concordia University
Hal Sadofsky	Math	University of Oregon
Linda Samek	Math & Education	Corban College
Michael Ward	Math	Western Oregon University
Rena Weber	Math	Treasure Valley Community College
Jim Whittaker	Math	Blue Mountain Community College

Math 105 --- Math in Society

Course Description:

Math in Society is a rigorous mathematics course designed for students in Liberal Arts and Humanities majors. The course provides a solid foundation in quantitative reasoning, symbolic reasoning, and problem solving techniques needed to be a productive, contributing citizen in the 21st century.

Course Outcomes: Skills and abilities that result from the course.

- ✓ [MR] Mathematical Reasoning: Students will read a complex problem requiring quantitative and/or symbolic analysis, use flexibility in selecting a solution strategy, and impose an appropriate mathematical structure or mathematical procedure in solving the problem.
- ✓ [MH] Mathematical Habits of Thought: Students will determine the reasonableness and implications of mathematical solutions, and will recognize the limitations of the methods used in context.
- ✓ [MDM] Mathematical Decision-Making: Students will apply mathematical processes and solutions in making personal and societal choices.
- ✓ [MC] Mathematical Communication: Student will use appropriate representations to effectively communicate, orally and in writing, quantitative results and mathematical processes.
- ✓ [MS] Mathematical Symbols, Techniques & Computation: Students will demonstrate proficiency in the skills supporting mathematical understanding.

Major Course Topics:

These are the three major topics along with the required supporting topics for each. The major topics are listed in the order in which they should be taught. Reasoning logically and problem solving are skills that should permeate throughout the entire course.

1. Logical Reasoning and Problem Solving --- (10 – 20% of course)
 - ✓ Describing and Critiquing Arguments
 - ✓ Understanding the Language of Logic
 - ✓ Recognizing Common Logical Fallacies
 - ✓ Learning Strategies of Problem Solving (non-algebraic, showing another way)
2. Probability and Statistics --- (30% of course)
 - ✓ Counting --- Multiplication Property
 - ✓ Measures of Central Tendencies and Spread
 - ✓ Calculating and Interpreting Basic Probabilities
 - ✓ Interpreting Graphical Displays/Histograms
 - ✓ Margin of Error/Polls
 - ✓ Expected Value
 - ✓ Interpreting Distributions
 - ✓ Misuse of Data

3. Financial Literacy --- (20% of course)
 - ✓ Percent Sales and Income Tax
 - ✓ Simple and Compound Interest
 - ✓ Annuities
 - ✓ Loans and Credit Cards

4. Additional Math Topics --- (30% of course)

Additional topics that might be addressed include, but are not limited to:

- | | |
|------------------------|--------------------------|
| ✓ Graph Theory | ✓ Voting Theory |
| ✓ Gaming | ✓ Fermi Approximations |
| ✓ Game Theory | ✓ Infinities |
| ✓ Modeling Growth | ✓ Symmetry/Tessellations |
| ✓ Apportionments | ✓ Cryptography |
| ✓ Fractals | ✓ Binary Operations |
| ✓ Applied Trigonometry | ✓ Historical Numbers |
| ✓ Golden Mean | ✓ Proportional Reasoning |
| ✓ Math in Art | ✓ Scheduling |
| ✓ Math in Music | ✓ Logistic Models |
| ✓ Sequence and Series | |

While the major topics overlap in many ways with content addressed in courses in statistics and business mathematics, the focus in Math 105 is on the “big ideas” in these areas. That is, the aspects of logic, statistics, and finance which are essential knowledge for an educated citizenry. The course should not have extensive emphasis on procedures and details. The intent is to define a rigorous liberal arts quantitative course that provides an important piece of a well-rounded general education, namely, building a student’s ability to reason quantitatively. The list of major topics is meant to address this aim through a consistent focus while still leaving time, about 30% of the course, for additional math topics that can be relevant to a wide range of liberal arts and humanities areas. An instructor could choose to apply the time allotted for the Additional Math Topics area to delve deeper into one, or all of the Major Course Topics.

Prerequisite Skills for Math 105, Math in Society

In order for students to be successful in a rigorous college, transfer-level quantitative reasoning course it is essential that they have a firm foundation in basic number sense, the ability to reason algebraically, and the ability to read and interpret graphs. The following list of skills is intended to help frame our concept of a transfer-level quantitative reasoning course and to provide students and instructors with an understanding of the expectations we have for students who enroll in such a course. This list represents skills students should have entering this Math 105 course, not a list of skills corresponding to a specific math course. It is important to realize that students are not expected necessarily to achieve a high level of proficiency in all of these skills prior to entering Mth 105 as many of these skills will continue to be developed in this college, transfer-level course.

The Math 105, Math in Society, description of skills and outcomes presumes that students entering the course should have developed a skill set through a college developmental math sequence or from math courses taken in high school. These skills include the following:

Note: While many of these skills provide foundational support for more than one major course topic area in Math 105, the coding abbreviations in parentheses, where noted, suggest a primary link between a particular skill and one of the three major course topic areas listed for the course: LR = logical reasoning; FL = financial literacy; and PS= probability and statistics.

Number Sense

- Use standard order of operations to evaluate expressions (including fractions and exponents)
- Calculate with, and convert between, decimals, fractions, and percents (FL)
- Interpret and use scientific notation
- Use various strategies to perform estimations (products, ratios, relative sizes) (FL)
- Use, and convert between, units
- Increase or decrease a given value by a given percentage (FL)
- Calculate the relative change (percent) between two quantities (PS)

Algebraic Reasoning and Modeling

- Use variables to represent quantities (LR)
- Solve linear equations and proportions (FL)
- Create and use linear models in a variety of authentic settings (FL)
- Interpret slope as a rate or ratio as appropriate for the given context (FL)
- Apply exponent rules to simplify basic expressions with exponents. (FL)
- Recognize and describe the relationship between variables expressed in an algebraic equation or graphical representation (intuitive notion of a function)
- Use, and convert between, different representations of relationships (verbal, algebraic, numerical, graphical) (LR)
- Understand order of operations (LR)
- Be able to use Polya's problem solving principles (or at least have modeled and solved some application problems) (LR)

Graphical Sense

- Create and use simple graphs: lines, bar charts, pie charts, and histograms (PS)
- Read and interpret graphs, charts, and tables (PS)

Math 105 Convening Representatives (October 2014)

Oregon Community Colleges

Blue Mountain	Gary Parker
Central Oregon	Jessica Giglio
Chemeketa	Wayne Barber
Clackamas	Carrie Kyser
Clatsop	TJ Lackner
Columbia Gorge	Lucas Lembrick
Klamath Falls	George Harpham
Lane	Jessica Knoch
Linn-Benton	Nicole Francis
Mt. Hood	Maria Miles
Oregon Coast	Marge Burak
Portland	Virginia Somes
Rogue	Charlotte Hutt
Southwestern	Nikki Armstrong
Tillamook Bay	Geza Laszlo
Treasure Valley	Pat Rhodes
Umpqua	Mariah Beck

Oregon Universities

Eastern Oregon	Bryan Fisher
OIT	Not Participating
Oregon State	Scott Peterson
Portland State	Joe Ediger
Southern Oregon	Not Participating
University of Oregon	David Steinberg
Western Oregon	Not Participating

Special Guests

CCWD	Lisa Reynolds
HECC	Donna Lewelling
OCCA	Elizabeth Cox-Brand
ODE	Mark Freed