Who Takes Algebra in College and What Do They Need to Know?

Case Study: Augsburg College

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MAA CPS *Courses Below Calculus: A New Focus*
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CUPM Curricular Guide

Unfortunately, there is often a serious mismatch between the original rationale for a college algebra requirement and the actual needs of the students who take the course.

A critically important task . . . is to

- Clarify the rationale for the requirements,
- Determine the needs of the students who take college algebra, and
- Ensure that the department's courses are aligned with these findings.

From CUPM p. 27

Today's talk –

Context – Augsburg College
CUPM Curricular guide recommendations
Our Course & Examples
What Makes it Work?

Augsburg College, Minneapolis

Private, 4-year, lib arts based, urban.
≈ 3,000 students, mainly undergrad.
≈ 40% need developmental math.

Math Courses below Calculus

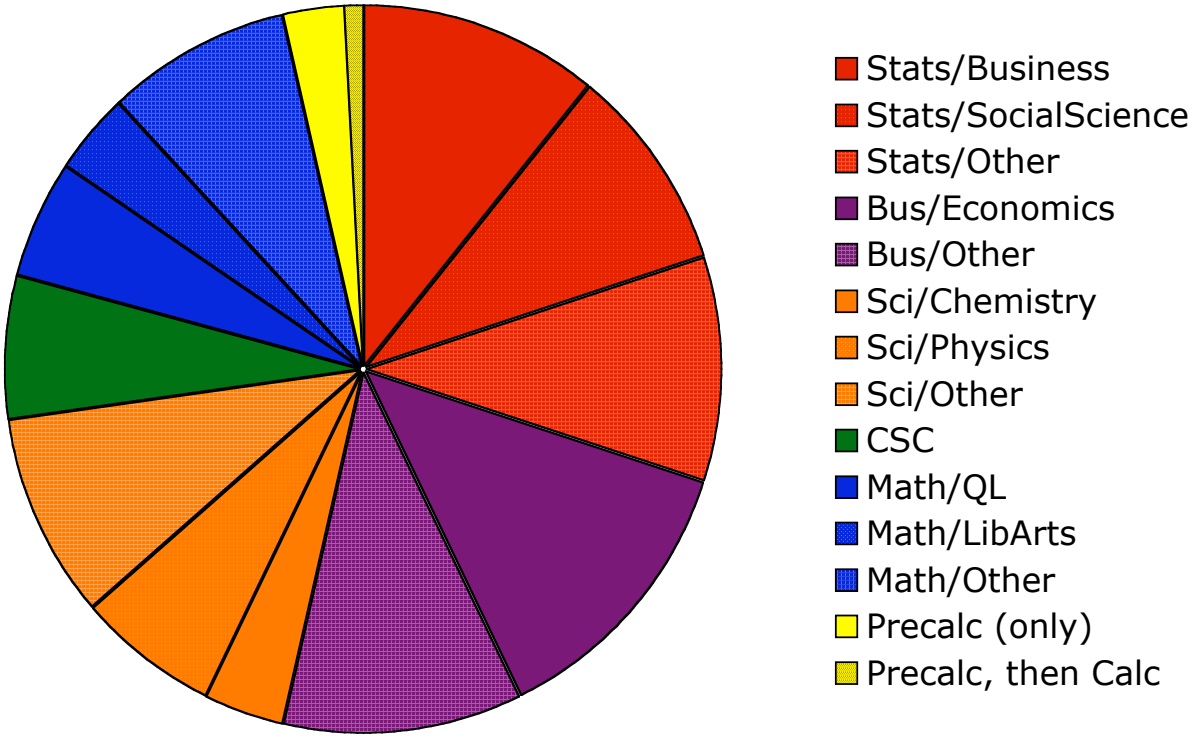
Pre-algebra, non-credit
➡ Applied Algebra (Math 105), credit
Precalc, Stats, QL, Lib Arts, (req. 105)

Graduation requirement

= MAT 105 (or place out)
+ 2 Science or Math courses
+ Quantitative Literacy course

After Algebra

≈ 500 students from Augsburg College
≈ 1,200 courses – counted once per category (slice)



What does your institution's pie chart look like?

Our Course Development

1994 Consult w/ client faculty Augsburg
    1995/2006? AMAYTC Crossroads
1997-9 Local text, assessment, revision
    2001 CUPM/CRAFTY/Curr Found Project
2004+ Expanding text w/ CC

Our Learning Objectives

Can perform key skills
    Calculator, order ops, decimals, %,
    Units, reasonableness of answers
    Interpret table, graph, equation
    Model w/ table, graph, equation
Understand key concepts
    Variable, function, linearity, solution
    Exponential growth, rate of change
Recognize math ideas in applied contexts
Confident in their ability to do math

Offer suitable courses . . . designed to

- Engage students in a meaningful and positive intellectual experience;
- Increase quantitative and logical reasoning abilities needed for informed citizenship / workplace;
- Strengthen quantitative and mathematical abilities that will be useful to students in other disciplines;
- Improve every student's ability to communicate quantitative ideas orally and in writing;
- Encourage students to take at least one additional course in the mathematical sciences.

From CUPM p. 28

"A Collective Vision: Voices of the Partner Disciplines," (CRAFTY)

Students should be able to . . .

- Create, analyze, and interpret basic mathematical models from informal problem statements;
- Argue that the models constructed are reasonable; and
- Use the models to provide insight into the original problem.

- Algorithmic skills much less important than understanding the underlying concepts.

From CUPM p. 29

Our Response –

Math 105: Applied Algebra

Applications-rich, modeling-based.

Diverse – adults, LD, math anxious.

Since 1994 ≈ 83% pass (17% FDW).

Meets students' interests & needs –

And it's fun to teach!

Course Topics

Intro to algebra ..... 4 weeks

Variables, tables, graphs, units, sci notation,
1st look at linear & exponential equations,
Using & solving equations, rate of change.

Linear models ..... 3 weeks

Proportionality & Power models .. 2 weeks

Exponential models ..... 3 weeks

Quadratic & Polynomial models .. 2 weeks

Example (from the 1st quiz):

Your sink is clogged. The plumber charges $100.00/hour plus a trip fee of $75.00 for coming to your house.

How many minutes did the plumber work if the bill totals $210.00?

a) Identify the variables (incl. units).
b) Make a table and graph illustrating the dependence.
c) Use them to approximate the answer.
d) Can you figure out the exact answer?

Example (from mid-semester):

Your company needs a new photocopier. One machine costs $10,000 and $250/month for service. Another machine costs $12,999, but then only $149/month for service.

Which copier should you buy and on what factors might this decision depend?

a) Make a table comparing the total costs of each machine.

b) Draw a graph and use it to approximate the answer.

c) Identify the variables and write an equation illustrating the costs.

d) Solve the linear system to find the answer. (Check that it agrees!)

Example (from the final exam):

Carl has been on a new diet and exercise plan and has steadily lost weight. He began at 220 pounds and now, 8 weeks later, he weighs 184 pounds.

When do you expect Carl to reach his goal weight of 175 pounds?

a) Construct a *linear* model and use it to answer the question.

b) Construct an *exponential* model and use it to answer the question.

c) Draw a graph showing both models.

d) Which model seems more reasonable? Explain.

What makes it work?

Focuses on what students need to know – for all after courses, not just precalc

Emphasis is on conceptual understanding

100% in context of concrete, realistic applications.

- Makes sense, interesting, relevant
- Engages students, own generalizations
- Useful, important in its own right

Comfortable learning environment

- Not presume mastery intro algebra
- Reviews only when and if needed
- Presents content cyclically
- Appropriate use of technology
- Frequent, predictable assessments
- Text supports instructor's comfort
- Belief that all students can learn math

Closing thought

With common sense and some algebra
you can understand the world better
than you can with common sense alone.

Prof. Ethan Bolker in *Using Algebra*

For more info
Or to preview/class-test text:

http://www.augsburg.edu/math
/faculty/doree.html

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