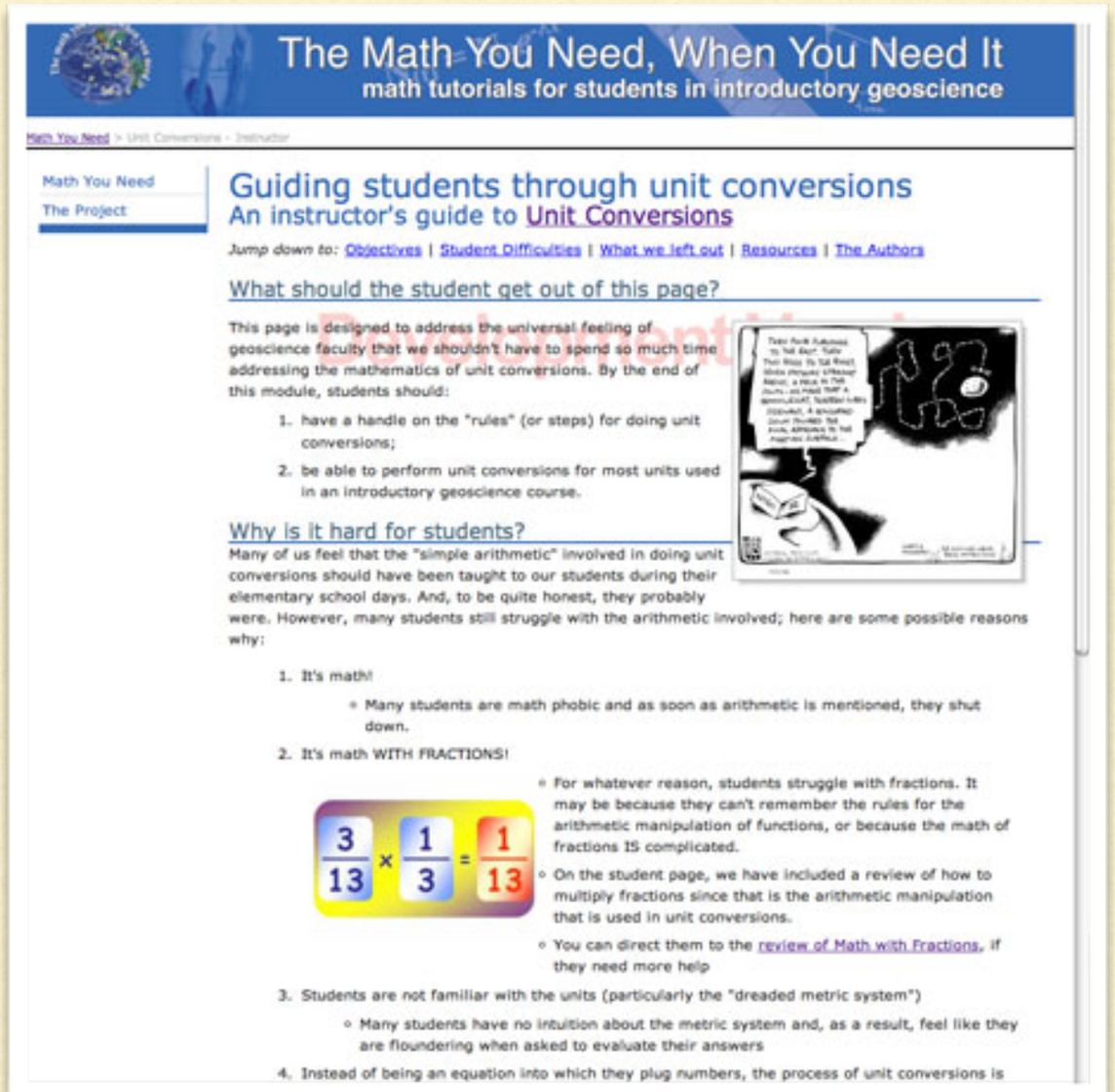
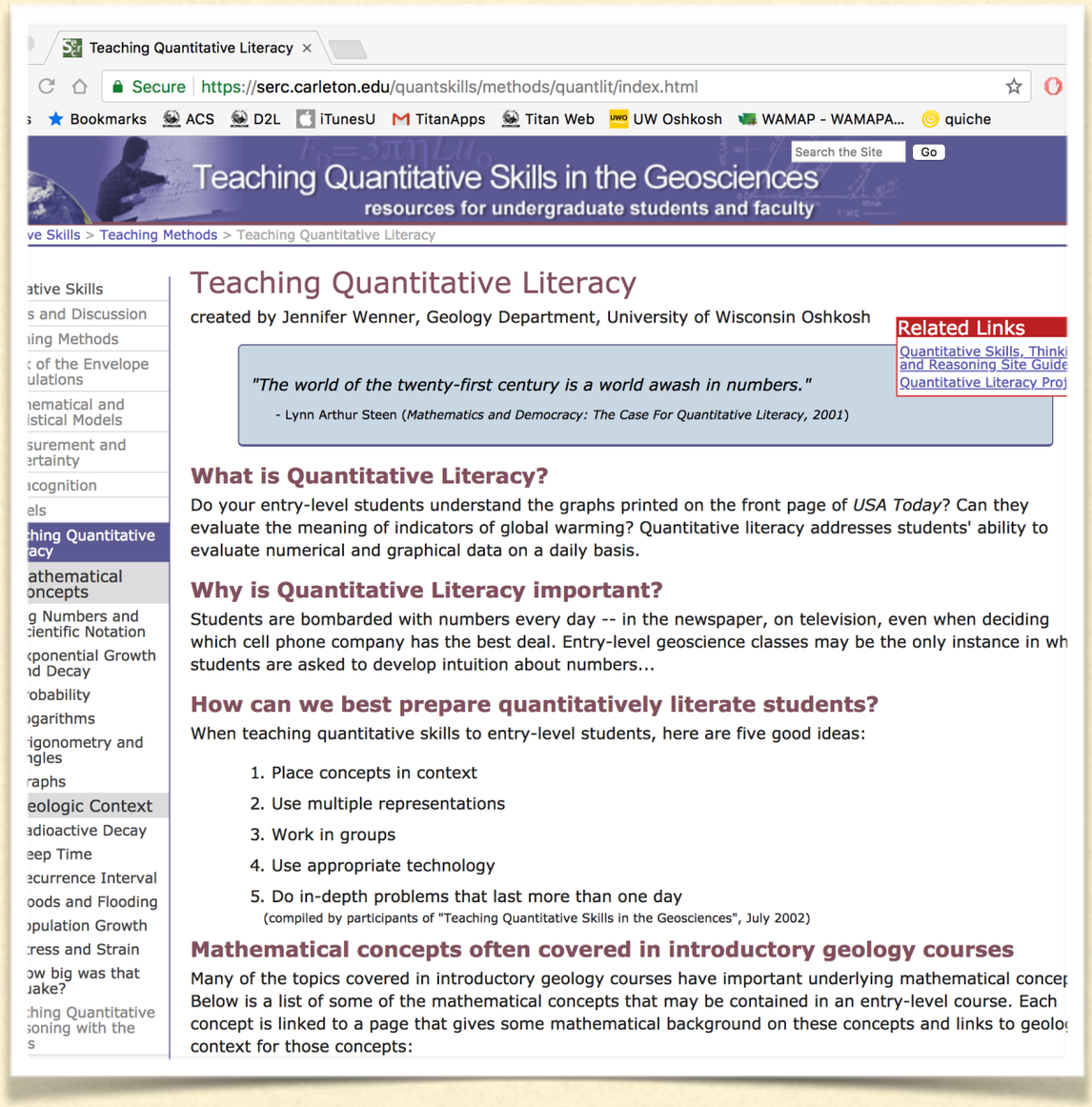
TEACHING FOR QUANTITATIVE LITERACY IN UNDERGRADUATE GEOSCIENCE COURSES

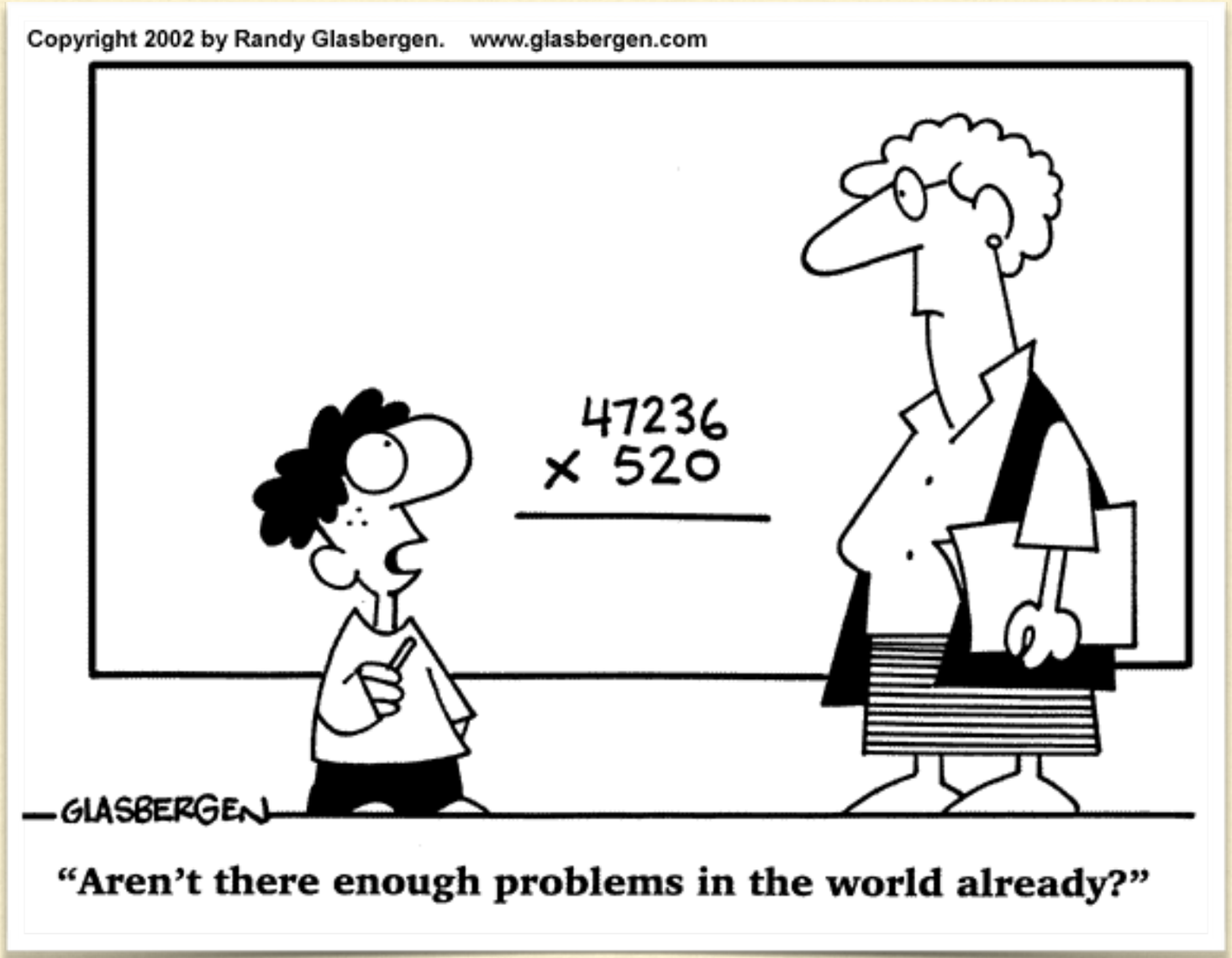
Earth Educators' Rendezvous, 2018, Morning Workshop,
8 am - 11:30 pm, M-W
Jennifer Wenner, facilitator

MY WORK IN QUANTITATIVE LITERACY FOR GEOSCIENCE





WHAT IS QUANTITATIVE LITERACY?

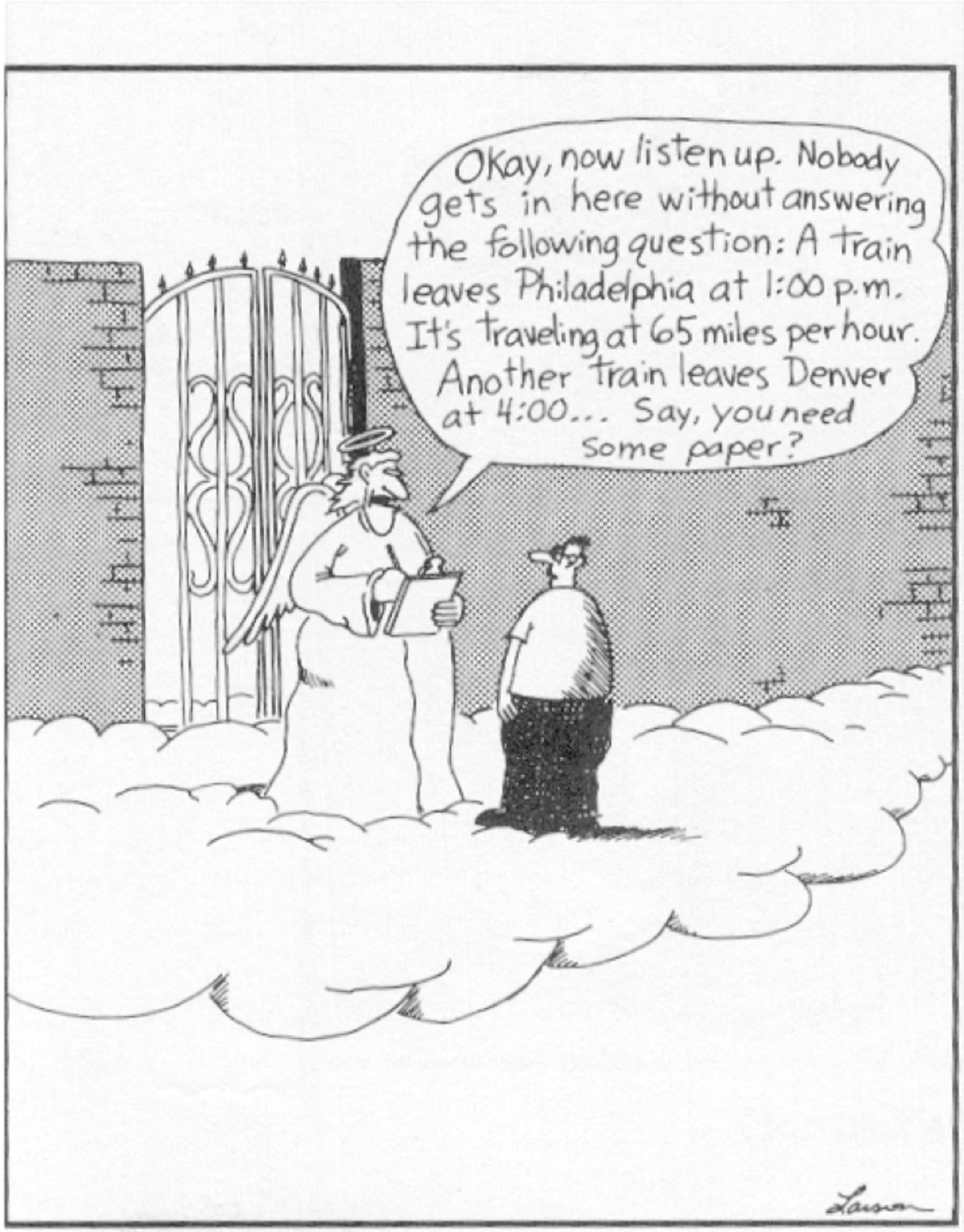


"Quantitative literacy is…a habit of mind…that employs and enhances both statistics and mathematics. Unlike statistics which is primarily about uncertainty, [it] is often about the logic of certainty. Unlike mathematics which is primarily about … abstract structures, [QL] is often anchored in data derived from and attached to the empirical world…[T]his inextricable link to reality makes [QL] every bit as challenging and rigorous as mathematical reasoning. -L. Steen, *The Case for QL*, 2000

WHAT IS QUANTITATIVE LITERACY?

- Reasoning with quantitative concepts
- not just performing calculations
- MATH IN CONTEXT - an important skill for an informed citizenry

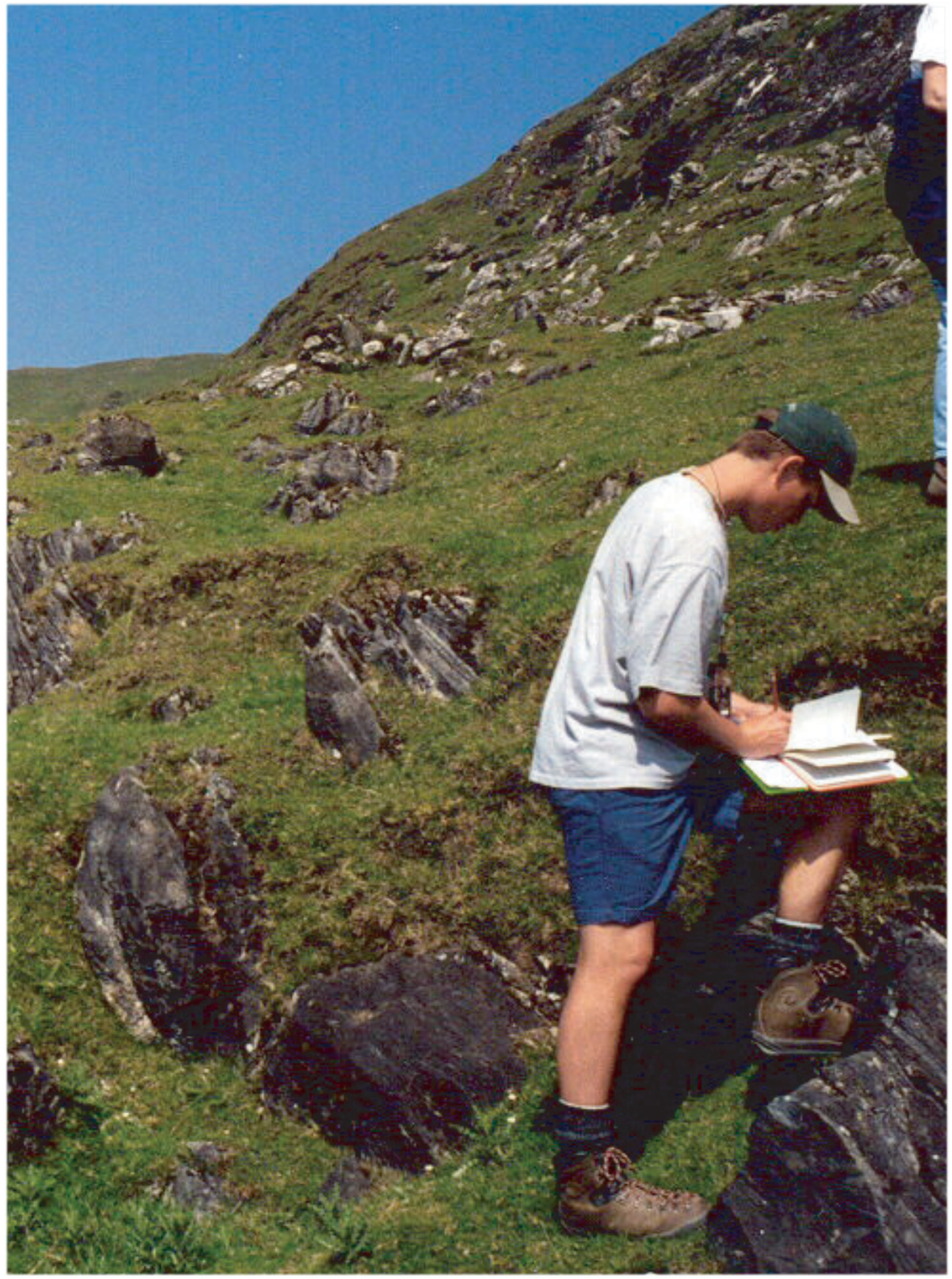
WHY IS IT IMPORTANT?



Math phobic's nightmare

WHAT IS THIS WORKSHOP ABOUT?

How do we efficiently and effectively prepare our undergraduate students for a number-rich geologic world?



WHAT WILL YOU ACCOMPLISH THIS WEEK?

- Monday
  - Discuss why QL is hard for our students (and how to help)
  - Talk with each other about important quantitative skills for your courses
  - Explore and discover topics in your course(s) where QL or support for QL is needed
- Tuesday
  - Incorporate best practices for supporting students in learning QL into your course(s)
  - Develop resources and/or problem sets that use best practices for your students (may be a team effort)
- Wednesday
  - Build resources, problems and best practices into your syllabus

WHAT *MATH* CONCEPTS ARE ESSENTIAL?

THINK GENERALLY ABOUT

- **Why are QS hard for students?**
- What might you do to aid/support students?
- What geoscience topics are associated with the skills you've brainstormed?
- What mathematical concepts are used in multiple contexts?

MATH CONCEPTS IN THE GEOSCIENCES

- Arithmetic/Computation
- Fractions and Ratios
- Units and Unit Conversions
- Scientific Notation
- Estimation
- Algebra
- Logarithms/Exponential Functions
  - Exponential Growth and Decay
  - Logarithms
- Geometry and Trigonometry
- Graphs
- Vectors and Matrices
- Probability and Statistics
  - Probability
  - Error Analysis
  - Correlation
  - Describing Data Distribution
  - Significance (Signal vs Noise, Uncertainty)
  - Data Trends/ Curve Fitting/ Regression
- Problem Solving/Equations
- Models and Modeling
- Differential Equations and Integrals
- Fourier Series, Spectral Analysis
  - Inversions

USE YOUR SYLLABUS TO THINK ABOUT

- What topics in your course are ripe for quantitative problems/ activities?
- Are there topics that utilize the same mathematical concepts?
- Do you already have some quantitative problems?
- What kinds of support (outside of class, online, in class) do you need to be able to integrate more QL into your classes?