

How *Mathematica* improves my teaching

Christopher R. H. Hanusa
Queens College, CUNY

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Talk Overview

- ▶ Teaching students *Mathematica*
 - ▶ Teaching *Mathematica* in class
 - ▶ Mathematical Modeling
 - ▶ Mathematics with Mathematica
- ▶ Using *Mathematica* to improve clarity
 - ▶ Examples from Graph Theory
 - ▶ Examples from Mathematical Modeling

Mathematical Modeling at Queens College

- ▶ **Audience:** Future high school math teachers
- ▶ **Topics Covered:**
 - ★ Modeling Process
 - ▶ Function Fitting
 - ▶ Linear Regression
 - ▶ Transition Matrices
 - ▶ Simulation, Queuing Models
 - ▶ Linear Optimization
- ▶ **Final Group Project**
 - ▶ Own choice of subject
 - ▶ Apply modeling principles from class
 - ▶ 15–20 page paper and 15 minute presentation
- ▶ **Mathematica Goal:** Basic knowledge; for use in project.

Mathematics with *Mathematica* at Queens College

- ▶ **Audience:** Sophomore–Senior math majors
- ▶ **Topics Covered:**
 - ▶ Programming in *Mathematica*
 - ▶ Graphics in *Mathematica*
 - ▶ Recreational mathematics incl. 2-player games
- ▶ **Individual Projects**
 - ▶ Own choice of subject
 - ▶ Apply techniques from class
 - ▶ Commented *Mathematica* code and 10 minute presentation
- ▶ **Mathematica Goal:** Advanced knowledge with a focus in programming.

Introducing *Mathematica*

- ▶ Not a math class!
- ▶ Start with the basics
- ▶ Motivate its use
 - ▶ Integrate something difficult
 - ▶ Show interesting graphics
 - ▶ Showcase animations created through the `Manipulate` command
- ▶ Highlight habits of independent learners

Habits of independent learners

- ▶ Comfortable checking help (Documentation Center)
- ▶ Comfortable with code
 - ▶ Parsing the code
 - ▶ Understanding what commands do
 - ▶ Modifying or creating from a template
- ▶ Comfortable asking questions of other students

Summary of what I've learned

- ▶ Install software promptly
- ▶ Teach qualities of independent learners
- ▶ Create clear step-by-step tutorials
- ▶ Spend time demonstrating the material
- ▶ Incorporate projects to motivate the learning

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Graph Theory at Queens College

- ▶ **Audience:** High school math teachers & advanced majors
- ▶ **Example Topics:**
 - ▶ Ford–Fulkerson Algorithm (Maximum Flow / Minimum Cut)
 - ▶ Kempe Chains Argument (Five-Color Theorem)
 - ▶ The Turning Trick (Graph Decompositions)

Go now!

Summary of using *Mathematica* to improve clarity

- ▶ *Mathematica* helps me to generate graphics which are:
 - ▶ Precise
 - ▶ Colorful
 - ▶ Dynamic

Thank you

Christopher R. H. Hanusa
chanusa@qc.cuny.edu

Course syllabi and slides available online:
<http://qc.edu/~chanusa/>