



# INTRODUCTION TO SCUDEM

EXPLORING THE WORLD OF MATHEMATICAL MODELING

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# WHAT IS SCUDEM?

- **Definition**

- SCUDEM stands for SIMIODE Challenge Using Differential Equations Modeling.
- It's a competition where students solve real-world problems using differential equations.

- **Who can participate?**

- High school and undergraduate students interested in mathematics and modeling.

- **Hosted by**

- SIMIODE (Systemic Initiative for Modeling Investigations and Opportunities with Differential Equations)

- **Coached by**

- Dr. Mayer (🐶)



# WHY PARTICIPATE IN SCUDEM?

- **Enhance Your Skills**
  - Improve your understanding of differential equations and their applications.
- **Real-World Impact**
  - Work on problems that have real-world significance, such as epidemiology, environmental modeling, and engineering challenges.
- **Collaboration and Teamwork**
  - Work with a team to develop, solve, and present a mathematical model.
- **Gain Recognition**
  - Opportunity to be recognized for your innovative problem-solving and modeling skills.



# HOW DOES SCUDEM WORK?

- **Team Structure**

- Teams of 3 students work together on a problem.

- **Problem Selection**

- Problems are provided by SCUDEM, covering a range of real-world examples.

- **Modeling Challenge**

- Teams are given a choice between 3 problems that require a differential equations model to solve.
- Students create a mathematical model to represent the problem (with either an analytical or numerical solution)

- **Presentation**

- Teams create a 10 minute video to present their models and solutions to judges, focusing on clarity, creativity, and accuracy.



# TYPES OF PROBLEMS IN SCUDEM

- **Chemistry/Life Sciences**

- Problems in chemistry and life sciences focus on biological systems, chemical reactions, and ecological models. Differential equations are used to model everything from population dynamics to molecular interactions.

- **Social Sciences/Humanities**

- In social sciences and humanities, differential equations are used to model human behavior, social dynamics, and economic trends. These problems often involve modeling population changes, social networks, and decision-making processes.

- **Physics/Engineering**

- These problems involve applying mathematical models to physical systems, mechanical processes, or engineering designs. Differential equations are used to represent dynamic systems and analyze their behavior over time.



# PREPARING FOR SCUDEM

- **Study Differential Equations**
  - Focus on both theoretical and applied aspects of differential equations.
- **Practice with Past Problems**
  - Work on problems from previous SCUDEM challenges with your teammates to sharpen your skills.
  - Practice using your preferred program to model differential equations (MATLAB, Python, Mathematica, etc...)



# RESOURCES FOR SCUDEM

- **SIMIODE Resources**

- <https://qubeshub.org/community/groups/scudem>

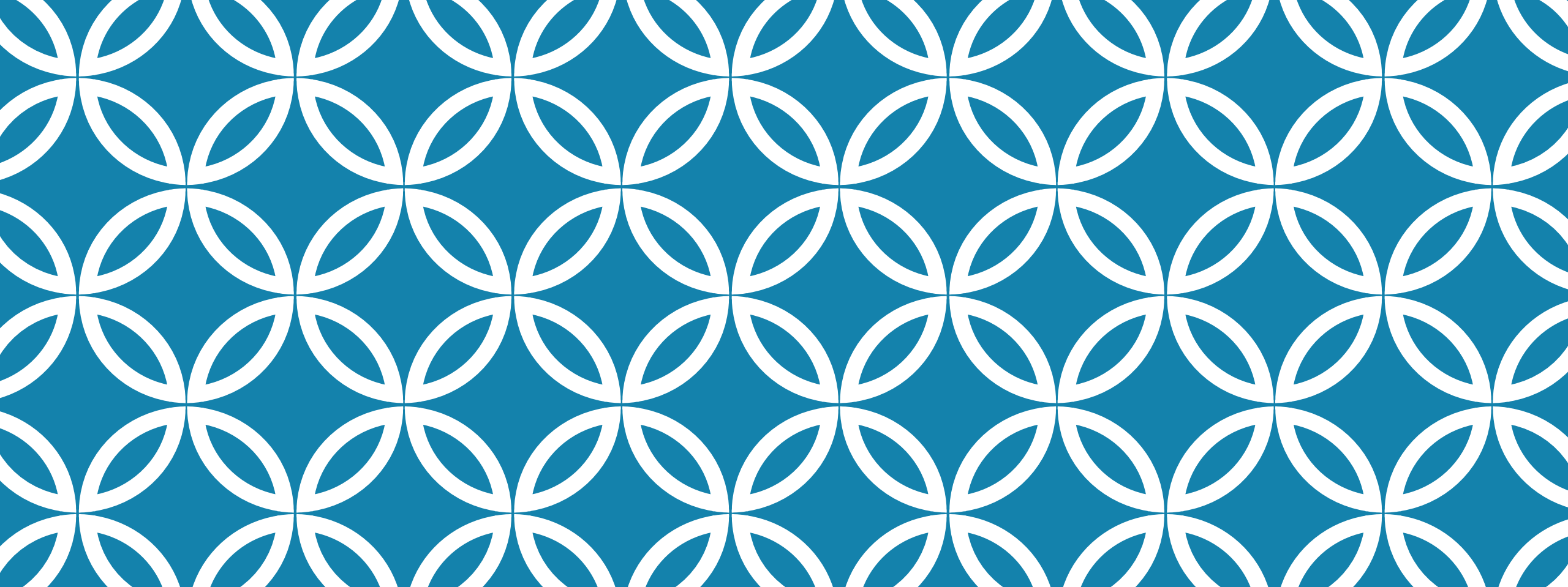
- **GT SCUDEM Site**

- <https://sites.gatech.edu/scudem/>

- **Learning Differential Equations**

- 3b1 b youtube videos
- Paul's online math notes
- Differential Equations: An Introduction to Modern Methods & Applications by James R. Brannan and William E. Boyce (Third edition)





**THANKS FOR WATCHING!**

