

MATHEMATICAL MODELING

Questions and Sentence Stems to Support Students' Equitable Participation

Mathematical Modeling Process



Problem Posing

- What do you notice?
- What do you wonder?
- What questions do I have?
- How can math help me solve a problem?
- I notice...
- I wonder...
- I can use math to ...

Making Assumptions & Defining Variables

- What information/data do I need?
- What quantities are important?
- What assumptions do I need to make?
- If I knew _____ then I can figure out _____.
- I need to assume that...

Building a Model

- What math can I use?
- How can I describe/predict the situation using math?
- How can I use math to make decisions?
- I can describe...
- I can predict...
- I solved the problem using...strategy

Analyze & Interpret

- Does the solution make sense?
- Is there another solution to consider?
- How does this solution apply to different problems?
- My solution is similar/different than...
- My solution makes sense/ is reasonable because...
- I can use this solution to other problems like...

Revise, Refine and Report

- What might I consider in my next model to revise or refine my solution?
- How can I share my solution?
- What might change if I considered other information?
- Next time, I will consider...
- I can use this solution to ...
- I can make my solution more precise by...

Mathematics A Modeling Approach

D Keegan



Mathematics A Modeling Approach:

A Mathematical Modeling Approach from Nonlinear Dynamics to Complex Systems Elbert E. N.

Macau, 2018-06-14 This book collects recent developments in nonlinear and complex systems. It provides up to date theoretic developments and new techniques based on a nonlinear dynamical systems approach that can be used to model and understand complex behavior in nonlinear dynamical systems. It covers symmetry groups, conservation laws, risk reduction management barriers in Hamiltonian systems and synchronization and chaotic transient. Illustrating mathematical modeling applications to nonlinear physics and nonlinear engineering, the book is ideal for academic and industrial researchers concerned with machinery and controls, manufacturing and controls. Introduces new concepts for understanding and modeling complex systems. Explains risk reduction management in complex systems. Examines the symmetry group approach to understanding complex systems. Illustrates the relation between transient chaos and crises. **Puzzles and Games: A**

Mathematical Modeling Approach Tony H. Ilm, 2016 Mathematical Connections Bruce Pollack-Johnson, Audrey F. Borchardt, 1997-01-01 **Mathematical Modeling** Mark M. Meerschaert, 1999

The second edition of this popular text offers a unique approach to mathematical modeling. Meerschaert offers an inviting introduction and applies a problem solving methodology in the three major areas of optimization, dynamical systems and stochastic processes. This edition takes a practical approach toward the solution of a variety of real problems including docking two vehicles in space, the growth rate of an infectious disease and wildlife management. Rigorous mathematical techniques required for a reasonable solution are introduced as necessary. Integrated Mathematics, 1998 *Calculus for the Life Sciences: A Modeling Approach* James L. Cornette, Ralph A. Ackerman, 2019-05-25. Calculus for the Life Sciences is an entire reimagining of the standard calculus sequence with the needs of life science students as the fundamental organizing principle. Those needs according to the National Academy of Science include the mathematical concepts of change, modeling, equilibria and stability, structure of a system, interactions among components, data and measurement, visualization and algorithms. This book addresses in a deep and significant way every concept on that list. The book begins with a primer on modeling in the biological realm and biological modeling is the theme and frame for the entire book. The authors build models of bacterial growth, light penetration through a column of water and dynamics of a colony of mold in the first few pages. In each case there is actual data that needs fitting. In the case of the mold colony that data is a set of photographs of the colony growing on a ruled sheet of graph paper and the students need to make their own approximations. Fundamental questions about the nature of mathematical modeling, trying to approximate a real world phenomenon with an equation, are all laid out for the students to wrestle with. The authors have produced a beautifully written introduction to the uses of mathematics in the life sciences. The exposition is crystalline, the problems are overwhelmingly from biology and interesting and rich and the emphasis on modeling is pervasive. An instructor's manual for this title is available electronically to those instructors who have adopted the textbook.

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Little,2013-01-15 Research today demands the application of sophisticated and powerful research tools Fulfilling this need The Oxford Handbook of Quantitative Methods is the complete tool box to deliver the most valid and generalizable answers to today's complex research questions It is a one stop source for learning and reviewing current best practices in quantitative methods as practiced in the social behavioral and educational sciences Comprising two volumes this handbook covers a wealth of topics related to quantitative research methods It begins with essential philosophical and ethical issues related to science and quantitative research It then addresses core measurement topics before delving into the design of studies Principal issues related to modern estimation and mathematical modeling are also detailed Topics in the handbook then segway into the realm of statistical inference and modeling with chapters dedicated to classical approaches as well as modern latent variable approaches Numerous chapters associated with longitudinal data and more specialized techniques round out this broad selection of topics Comprehensive authoritative and user friendly this two volume set will be an indispensable resource for serious researchers across the social behavioral and educational sciences *Biology in Time and Space: A Partial Differential Equation Modeling Approach* James P. Keener,2021-06-02 How do biological objects

communicate make structures make measurements and decisions search for food i.e. do all the things necessary for survival Designed for an advanced undergraduate audience this book uses mathematics to begin to tell that story It builds on a background in multivariable calculus ordinary differential equations and basic stochastic processes and uses partial differential equations as the framework within which to explore these questions **Mathematical Approaches to**

Software Quality Gerard O'Regan,2006-02-16 This book provides a comprehensive introduction to various mathematical approaches to achieving high quality software An introduction to mathematics that is essential for sound software engineering is provided as well as a discussion of various mathematical methods that are used both in academia and industry The mathematical approaches considered include Z specification language Vienna Development Methods VDM Irish school of VDM VDM approach of Dijkstra and Hoare classical engineering approach of Parnas Cleanroom approach developed at IBM software reliability and unified modelling language UML Additionally technology transfer of the mathematical methods to industry is considered The book explains the main features of these approaches and applies mathematical methods to solve practical problems Written with both student and professional in mind this book assists the reader in applying mathematical methods to solve practical problems that are relevant to software engineers The Oxford Handbook of Quantitative Methods Todd D. Little,2013 The Oxford Handbook of Quantitative Methods in Psychology provides an accessible and comprehensive review of the current state of the science and a one stop source for best practices in a quantitative methods

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