Introduction

MATHEMATICS IS THE MOST WIDELY STUDIED SUBJECT in the world. It is a subject with a distinguished and ancient past, but also a subject with an active present, affecting nearly every aspect of modern life.

Yet in spite of this, most people are skeptical when told that new mathematics is being created today. This is easy to understand when one realizes that the general public knows mathematics through arithmetic, high school algebra, and (perhaps) calculus. The most recent of these topics is 350 years old.

Volume 6 of the series *What's Happening in the Mathematical Sciences* provides evidence of the active nature of mathematics by highlighting ten notable research topics from the past few years.

The articles in this volume also highlight some common themes that run throughout the history of mathematical research. One theme is the surprising unity of mathematics—that solving established problems in one branch of mathematics may require tools and insights from what were thought to be unrelated branches of mathematics ("Millennium Problems," p. 2 and "New Insights," p. 52). Another is its unreasonable effectiveness—that abstract mathematics applied to physical systems often yields deep understanding that is sometimes hard to explain ("Navier-Stokes Equations," p. 78, "Mysteries of Insect Motion," p. 86, and "Brownian Motion," p. 100). And yet another theme is the hidden insight of mathematicians—that solving old problems often requires new insights and novel approaches that originate with young as well as established mathematicians, often through their joint efforts ("Venn-erable Problem," p. 40, "New Insights," p. 52, "Quadratic Number Fields and Beyond," p. 66, and "Classifying Hyperbolic Manifolds," p. 14).

This is truly current research. Three of these articles ("Millennium Problems," p. 2, "New Insights," p. 52, and "Brownian Motion," p. 100) describe work that was recognized with Fields Medals at the 2006 International Congress of Mathematicians held in August 2006 in Madrid, Spain. Fields Medals, awarded only every four years, are the analogue in mathematics of a Nobel Prize, but are awarded only to mathematicians under the age of 40.

This is a book for those who think of mathematics as a dull and dead subject. It will convince you that mathematics is both fascinating and alive, touching many parts of your everyday life and promising to grow even more lively in the future.

John Ewing
Publisher, American Mathematical Society