

Introduction

MATHEMATICS ENTERS OUR LIVES in so many ways that we often overlook its presence. We don't think about the number theory behind ATM transactions, or the algebra and geometry that enable rapid internet searches. With each passing year, mathematics has ever more everyday influence, even if it is invisible. Meanwhile, mathematics itself continues to grow, both broader and deeper. This eighth volume of *What's Happening in the Mathematical Sciences* presents some of the remarkable recent mathematical news.

The last few years had current events, both big and small, with mathematical connections. A veil was lifted on the role of mathematics in the economy as various pundits and key players tried to explain the financial crisis brought on by the collapse of major banking and insurance companies. Suddenly, the complex mathematical models that dominate Wall Street were in the news. "Mathematics and the Financial Crisis" looks at whether the models failed or if something else was to blame. A controversy of a different kind erupted with new recommendations for breast cancer screening, which called into question the conventional wisdom on mammograms. "SimPatient" looks at the mathematics that contributed to the reassessment. In a very different vein, mathematics entered the news as the Netflix prize showed how clever programming, clever mathematics, and the judicious combination of multiple algorithms could create a remarkably better method for making recommendations to movie fans, with definite implications for many other possible applications ("Accounting for Taste").

There were new results in familiar areas for mathematics. *Happening 8* looks at two results related to the dynamics of billiards: one classical but with a twist ("The Ultimate Billiard Shot"), one the quantum counterpart of billiards ("In Search of Quantum Chaos"). Symplectic geometry, which is one way to give geometric formulations of problems in dynamics, saw the solution of a major problem, the Weinstein conjecture, on periodic orbits ("A Brave New Symplectic World"). Mathematicians settled the Kervaire conjecture in topology, which finally answered a nagging question about spheres in higher dimensions ("As One Heroic Age Ends, A New One Begins"). In three-dimensional geometry, there was an amazing race to find the optimum packing of regular tetrahedral shapes. Long thought a dormant topic, a flurry of results showed that there was much we didn't know about the familiar world of three dimensions ("3-D Surprises"). Finally, recent work in probability gave mathematicians much greater insight into randomness, in particular the change from order to disorder ("Instant Randomness").

A lot has been going on in mathematics lately. We are proud to present this eighth volume of *What's Happening in the Mathematical Sciences* with news of some of the outstanding recent progress in mathematics. We hope you enjoy it.

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